

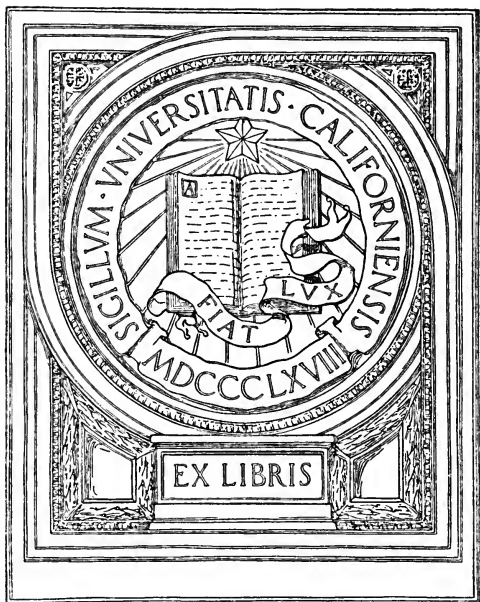
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DEFENSIVE MEASURES

AGAINST

GAS ATTACKS

HEADQUARTERS AMERICAN EXPEDITIONARY FORCES

FRANCE

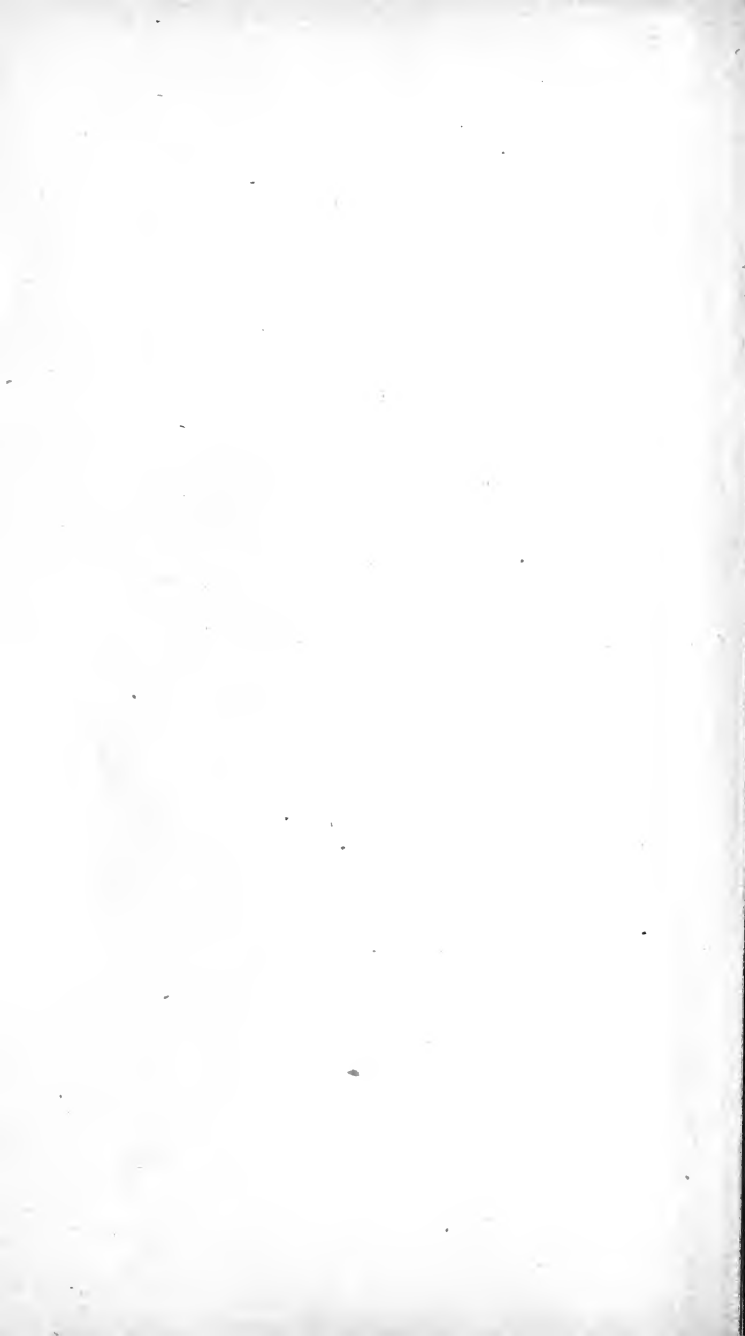
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November, 1917

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DEFENSIVE MEASURES

AGAINST

GAS ATTACKS



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DEFENSIVE MEASURES

AGAINST

GAS ATTACKS

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HEADQUARTERS AMERICAN EXPEDITIONARY FORCES

France, November 30, 1917.

The following rules and regulations governing defensive measures to be taken against gas attacks are published for the information and guidance of all concerned.

By Command of General Pershing :

JAMES G. HARBORD,
Brigadier General,
Chief of Staff.

Official :

BENJ. ALVORD,
Adjutant General.

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DEFENSIVE MEASURES

AGAINST

GAS ATTACKS.

I. — INTRODUCTION.

A. — GENERAL CONSIDERATIONS.

1. The following notes on defensive measures against hostile gas attacks have been compiled for the guidance of officers in instructing their men and giving orders on the subject.

2. In the absence of suitable protection the gases used in war are extremely deadly. Breathing only very small quantities may cause death or serious injury. Hence, it is essential that no time be lost in putting on the respirators or masks when a gas alarm is heard.

It cannot be too strongly impressed on all that the measures which have been elaborated to meet hostile gas attacks afford perfect protection, and if they are carried out properly and promptly no one will suffer from gas poisoning.

3. The whole basis for protecting troops against gas lies a) in keeping the appliances in perfect working order; b) in learning to adjust them rapidly under all conditions; and c) in ensuring that every man is given immediate warning. These results can only be attained:

1) By frequent and thorough inspection of all protective appliances. The inspections to be daily in the trenches.

2) By thorough instruction and training in their use.

3) By every man understanding and complying with all Standing Orders on the subject of defense against gas.

If these are effectively carried out, there is nothing to fear from hostile gas attacks. Officers must impress this on their men, since an important object of all anti-gas instruction should be to inspire complete confidence in the efficacy of the methods adopted.

STANDING ORDERS FOR DEFENSE AGAINST GAS.

I. — Carriage of Respirators.

a) *Within 12 miles of the front line* a box respirator or mask will always be carried.

b) *Within 5 miles of the front line* a box respirator will always be carried, and every man will be clean-shaven, except that a moustache may be worn.

c) *Within 2 miles of the front line and within areas specially exposed to gas shelling*, the box respirator and mask will always be carried. The respirator will be carried in the "Alert" position. It will be worn outside all clothing, and nothing will be slung across the chest in such a way as to interfere with the quick adjustment of the respirator. The chin strap of the steel helmet will be worn on the *point* of the chin.

d) Military Police will report all cases of infringement of the above orders.

e) The above-mentioned zones will be conspicuously marked by each Corps, in such manner as to attract the attention of persons entering them.

f) When not carried in the "Alert" position, the box respirator will be carried over the left hip, the sling passing over the right shoulder. Nothing shall be worn so as to interfere with the immediate *shifting* of the respirator to the "Alert" position. If the mask is also carried, it will be over the right hip, so as not to interfere with shifting the box respirator to the "Alert" position, the sling passing over the left shoulder but under the sling of the respirator.

II. — General Precautionary Measures.

Within the two mile limit the following will be observed :

a) Box respirators will be inspected *daily*.

b) Gas N. C. O.'s will inspect daily all gas alarm appliances and anti-gas stores. They will see that gas-proof dugouts are in good order and the blankets kept moist.

c) All sentries will act as Gas Sentries and will be provided with alarm appliances to give warning in case of gas shelling or a gas cloud attack.

d) Each sentry group will have a definite area to alarm in the event of a gas cloud attack or bombardment.

e) Sentries must be posted to give warning to men in dugouts.

f) All working parties of 10 or more men will have a sentry posted to give warning in the event of gas being used by the enemy.

g) Precautions will be taken to protect ammunition from the corrosive action of gas.

h) Stores of fuel will be kept for clearing dugouts.

i) Units in the line will make wind observations, and sentries will be warned to be on the alert for signs of cloud gas *whenever the wind is in a dangerous quarter.*

In the area between two and twelve miles from the front line the following will be observed :

j) Anti-gas appliances will be inspected at least once a week and immediately before men proceed to any point within the two mile limit.

k) All sentries, traffic control men, military police, etc., when on duty will act as gas sentries and will be provided with suitable alarm devices where necessary.

l) Men may be allowed to take off their respirators when sleeping, but must keep them within reach.

m) Arrangements will be made by Commanders of units and Area Commanders to communicate a gas alarm rapidly to all ranks.

III. — Action to be taken in the event of an enemy Gas Shell or Trench Mortar Bombardment.

a) At the first sign of *gas shell* of any kind or on hearing the alarm, the breath must be held and the respirator adjusted immediately without waiting until the presence of gas is recognized.

b) The alarm will be spread immediately to all troops in the neighborhood :

1) By gongs, rattles, or klaxons ;

2) By shouting " Gas shells "—after the respirator has been adjusted ;

3) By runners where necessary.

Strombos Horns will *not* be used.

Men in dugouts, observation posts, and mine shafts must be warned and sleeping men roused.

c) Gas-proof dugouts will be closed immediately, and any fires burning in such dugouts put out. Care must be taken that men do not enter protected dugouts if their clothing has been exposed to gas.

d) Sentries will be posted at suitable points to warn men to put on their respirators before entering the shelled area. These sentries will not be withdrawn until the area is free from gas.

IV. — After a Gas Shell or Trench Mortar Bombardment the following precautions will be observed.

a) *Respirators will be worn until permission to remove them is given by an officer.*

b) Gas may remain in liquid form on the ground for several hours after a bombardment. When it is impossible to withdraw men from an infected area, respirators will be

worn until the ground is clear. *Gas shell holes* will be covered with *fresh earth* when possible, or with chloride of lime if available.

c) Closed spaces such as dugouts and cellars may retain gas for many hours and must be cleared by means of fires. Men will not enter such places without wearing respirators until permission has been given by an officer.

d) When a man is close to the burst of a gas shell his clothes may become contaminated with liquid. When possible the clothes will be removed and exposed to the air. Care must be taken that men sleeping in closed spaces are not gassed by long exposure to small quantities of gas brought in on their clothing or equipment.

e) Men affected by gas will be spared exertion as much as possible and casualties will not be allowed to walk to the Dressing Station.

f) Transport will move from the shelled area when possible. Horse respirators will be adjusted on all animals remaining in the shelled area.

V. — Action to be taken in the event of an enemy Cloud Gas attack.

The Alarm.

a) Alarm will at once be given by all means available : — by Strombos horns, gongs, rattles, telephone, and, if necessary, by orderly. Sentries will warn all ranks in the trenches, dugouts, observation posts, or mine shafts.

b) Sentries on Strombos Horns will sound the horn (1) when they detect *cloud* gas, (2) when they hear *other Strombos Horns* sounding. Strombos Horns will *not* take up the alarm from gongs and rattles.

c) In order to restrict the spread of false alarms, when possible, Strombos Horns in back areas will be placed so that they need not be sounded until the alarm is confirmed by telephone.

d) Should the gas cloud be unaccompanied by an infantry attack, no S. O. S. signal will be sent, but the letters G. A. S. will be telephoned or telegraphed, followed by the name of the trench opposite to which the gas is being liberated.

This message will **not** be sent in case of a *gas shell bombardment only*.

e) Arrangements will be made for an immediate report of a hostile gas attack to be sent to all formations within 40 kilometers (25 miles) giving the map reference of the point of attack, as follows :

Divisions will warn :

Corps H. Q. ;

All other Divisions of the same Corps ;

(If a flank Division) Neighboring Division of adjoining Corps.

Corps will warn :

Army H. Q. ;

All other Corps of same Army ;

(If a flank Corps) Neighboring Corps of adjoining Army.

f) Arrangements will be made for the warning to be repeated, where necessary, to an officer in each village or camp within a radius of 40 kilometers of the point of attack, who will be responsible for warning units billeted there.

g) Corps will arrange to warn civil authorities who are responsible for the protection and warning of all civilians within the Corps area.

Action on the alarm being given.

h) *There should be as little movement and talking as possible.*

All ranks will at once adjust their small box respirators. Men in dugouts will do so before leaving dugouts.

i) The blanket curtains of protected dugouts and cellars will be properly adjusted, and fires in such dugouts put out.

j) Troops in the front lines, and wherever the tactical situation demands, will stand to arms.

k) In rear lines there is no objection to troops remaining in dugouts, where the tactical situation permits, with the exception of sentries and of officers and N. C. O.'s on duty.

l) All bodies of troops or transport on the move will halt, and working parties will cease work until the gas cloud has passed.

m) If a relief is in progress, units should stand steady as far as possible until the gas cloud has passed.

n) Supports and parties bringing up ammunition and grenades will only be moved up if the tactical situation demands.

Action during an Enemy Cloud Gas Attack.

o) The troops in the front trenches will open a slow rate of rifle fire at once against the enemy's trenches, and occasional short bursts will be fired from machine guns to ensure that all weapons are in working order.

p) Corps will arrange a suitable artillery program to be carried out in the event of a *cloud gas attack*.

Action after an Enemy Cloud Gas Attack.

q) Trenches will be cleared of gas with Anti-gas fans and sandbags.

r) Respirators will be worn until permission to remove them is given by an officer.

s) *A sharp lookout will be maintained for a repetition*

of the attack as long as the wind continues in a dangerous quarter. Men will sleep on the fire-step within reach of a sentry.

t) The instructions given in Section 4 (c) above, with regard to entering dugouts, etc., will be observed.

u) No man suffering from the effects of gas will be allowed to walk to the Dressing Station, or exert himself in any other manner.

v) The clearing of trenches and dugouts must not be carried out by men who have been affected by the gas.

w) After a gas attack, troops in the front trenches are to be relieved of all fatigue and carrying work for 24 hours, by sending up working parties from companies in the rear.

x) Horses which have been exposed to the gas will not be worked for 24 hours if it can be avoided.

y) Rifles and machine guns must be cleaned after a gas attack. Oil cleaning will prevent corrosion for 12 hours, but the first opportunity must be taken to clean all parts in boiling water containing a little soda.

z) Small arms ammunition must be carefully examined. All rounds affected by the gas must be replaced by new cartridges immediately. The rounds affected will then be cleaned. Especial attention must be paid to the brass clips.

zz) Expended air cylinders of Strombos Horns will be replaced by full ones.

VI. — Anti-Gas Trench Stores.

a) These comprise :

Extra supply of respirators and masks (5 % of strength);
Strombos horns and other alarm devices;

Wind vanes ;

Gas-proof coverings for dugouts ;

Anti-gas fans ;

Stores of fuel for clearing dugouts ;

Vermorel Sprayers ;

Gas sampling apparatus.

b) Commanders of formations or units relieving one another are responsible that trench stores are duly turned over and receipted for, and that they are in good condition, and in proper positions for use or replacement.

c) The actual taking over should be done by company (battery) Gas N. C. O.'s, who will go up with the advance party (if possible in daylight) for this purpose. They will report any defects to their Company (battery) commander.

d) As soon after the actual taking over as possible the Regimental Gas Officer will make an inspection of all anti-gas arrangements and stores. He will call the attention of Company Commanders to any defects or deficiencies for correction. He should collect all possible blind gas shells to be sent to the laboratory for test.

GENERAL PRINCIPLES OF TRAINING IN GAS DEFENSIVE AGAINST GAS SHELL BOMBARDMENTS.

What to expect. — Every man should know what to expect, and should be told to regard as gas shells all those which burst with a small detonation, and to remember that gas shell is difficult to detect when fired with high explosive shell as it usually is.

The enemy has recently been firing large caliber shells with both gas and a large amount of high explosive so that it is practically impossible to tell which are gas shells and which are not. Hence, each man must be prepared to wear his mask during every bombardment.

Gas alarm. — Every man must be practiced in spreading the alarm by shouting "Gas shell" as soon as he has adjusted his respirator. Warning must be conveyed to troops to the leeward of the area bombarded. Sentries should be posted to warn men to put on their respirators before entering affected areas. Arrangements must be made to warn men who are asleep, immediately a gas bombardment begins.

Wearing box respirators. — Box respirators must be adjusted properly during gas shell bombardments and must not be removed after the bombardment is over except on the order of an officer. If removing respirators is left to the judgment of individual men, casualties are bound to occur.

Respirator Drill. — It is important that men should be practiced in adjusting the small box respirator while wearing steel helmets by going through the necessary motions even when not wearing the steel helmet. Practice in prolonged wearing is necessary, as many instances have occurred of men having to wear the small box respirator for five to eight hours. This condition will get worse as the war continues. Men must also be practiced in moving in the dark, and in speaking while wearing the respirator.

Realistic training. — It is important that the actual training should be made realistic, and combined with ordinary work; e. g., a party engaged on night operations might suddenly be given the alarm "Gas shell", whereupon the correct action should be taken, and respirators worn for an hour without interrupting the operations.

Night practices are essential, because gas shelling nearly always occurs at night. Specialists and men of all arms must be able to perform their duties in the dark while wearing their respirators.

Gas-proof Dugouts. — All ranks must be acquainted with the proper method of adjusting the blankets at the entrances

to gas-proof dugouts. The adjustment of the blankets should be practiced in the dark when wearing box respirators.

The value of gas-proof dugouts and cellars has been clearly demonstrated. This should be borne in mind in view of the inflammation of the skin produced by mustard gas. Billets and dugouts into which gas has entered must not be occupied until they have been completely cleared of gas by fires or fans.

Fans must be used only when fire is impossible, as they are far less efficient than a brisk fire for a few moments. 1 lb. of dry wood for each 100 cu. ft. of space in the dugout burned briskly for 10 to 15 minutes will clear it of all gas.

How to detect gas and what to do when it is detected.

1. With the present wide use of gas in artillery shells, trench mortars, bombs, cloud gas waves, and even hand grenades, it is a very difficult matter to be sure there is no gas around.

2. Everywhere within the reach of artillery : front line, communication trenches, batteries, billets, or, in fact, wherever a body of men are likely to be found, gas shell bombardment is to be expected and guarded against. Salvos of gas shells are sent over in the hope of catching bodies of men unprepared or unwarned. Such a bombardment is apt to be heavy, especially at first, in order to develop a strong concentration of gas. Not only will gas shells be sent, but also frequently a large proportion of high explosive shells in an attempt to conceal the former or to detract attention. Also, gas shells are sometimes now made with such a large amount of high explosive that their burst cannot be told from ordinary high explosive shell.

a) Gas shells usually make a peculiar "wobbling" noise when they come through the air, due to their being filled with liquid instead of a solid.

b) Generally in the case of both gas artillery shells and gas trench mortar bombs, the sound of the burst is very small and they are therefore sometimes considered as "duds" (high explosive shells that fail to burst).

c) When a gas shell explodes most of the liquid gas turns into vapor, sometimes in the form of a white cloud. However, this is not true of all kinds of gas.

d) If a gas shell bursts 20 yards or less to windward of a body of men they have no time to wait for any alarm, and unless each acts for himself he will be killed. *Each must hold his breath and get his respirator or mask on as quickly as possible.* In doing so, follow the methods described in Drill "B" or Drill "C". *Whenever putting on a mask, do so according to the methods given in the Drills, because these have been worked out with great pains to save loss of time.*

Mustard Gas (Dichlorethylsulphide). — The slight smell of mustard gas and the absence of any immediate effect on the eyes and lungs make it necessary that precaution against gas shell should be taken when any shells are falling nearby, even if no gas be smelled or recognized.

3. Cloud gas is usually, if not invariably, phosgene or phosgene mixed with chlorine. Both have a very distinct irritating odor like that given by chloride of lime, well known as a disinfectant. Both are irritating to the throat and cause coughing. There is no difficulty in recognizing them, but **one full breath of a phosgene cloud will kill a man, therefore, hold your breath while putting on your respirator or mask.** The responsibility for recognizing cloud gas rests with the sentries in the front line trenches. The actual gas cloud is frequently preceded a few seconds by a hissing sound like the escape of steam; this noise, however, can not always be heard on account of artillery or machine gun fire. In the day time these gas clouds are visible at quite a distance and readily recognized, but as they are now used only at night or when there is a fog, it is seldom that they can be seen more than five seconds away.

Summary.

There are three things to do :

First : Hold your breath.

Second : Keep on holding your breath until your respirator or mask is fully and accurately on.

Third : Give the alarm for all your comrades.

B. — NATURE OF GAS ATTACKS.

I. — Gas clouds.

4. This method of making a gas attack is entirely dependent on the direction of the wind. The gas is carried up to the trenches as a liquid in steel cylinders. These are dug or set in the trench and connected with pipes leading out over the parapet. When the valves of the cylinders are opened, the gas escapes, usually with a hissing sound, which, on a still night, can frequently be heard at a considerable distance. It mixes with the air and is carried by the wind towards the opposing trenches, spreading out as it goes forward. A continuous wave of gas and air is thus formed, the color of which may vary :

a) Because of the weather conditions. In very dry air it may be almost transparent and slightly greenish in color, while in damp weather it forms a white cloud.

b) Because it may be mixed with smoke of any color.

5. A cloud attack can only take place when there is a steady but not too strong wind blowing from the enemy's

lines towards our own. A wind between 4 and 8 miles an hour is the most likely condition. An 8-mile wind will carry the gas cloud twice as quickly as a man walks rapidly.

Gas attacks may occur at any time of the day, but are most likely to be made during the night or in the early morning.

Rain is without appreciable effect on a gas attack. Fogs have hardly any effect, and may, in fact, be taken advantage of to make an attack unexpectedly. Watercourses and ponds are no obstruction to a gas cloud.

6. The gas used by the enemy is generally a mixture of chlorine and phosgene, or pure phosgene, both of which are strongly asphyxiating. The gases are heavier than air, and therefore tend to flow along the ground and into trenches, shelters, craters, and hollows. The gas cloud may flow around slight rises in the ground, thus leaving patches of country which remain free from gas.

7. Even when very dilute, chlorine can be recognized by its peculiar smell, which is like chloride of lime, but stronger and more irritating.

Both chlorine and phosgene also exert a strongly corrosive action on metals, so that the metal parts of arms must be carefully protected by oiling them.

8. The speed with which the gas cloud approaches depends entirely on the wind velocity. Gas attacks have been made with wind velocities varying from 3 to 20 miles per hour, i. e., from $1\frac{1}{2}$ to 10 yards per second. In a 9-mile wind, the gas would reach trenches 100 yards distant in 20 seconds.

Gas attacks have been made on fronts varying from 1 to 5 miles. Their effects at points up to 12 miles behind the front trenches have been sufficiently severe to make it necessary to wear masks.

II. — Gas projectiles.

9. The use of these depends very little on the direction of the wind. In gas projectiles such as shells, hand grenades, and trench mortar bombs, a part or whole of the explosive charge is replaced by a liquid which is converted into gas by the explosion. The explosive force and noise of detonation of these projectiles is generally less than that of the ordinary kind, and a large number of them are usually discharged into a comparatively small space. After the explosion, the liquid gas forms a small cloud, though some of it may sink into the ground and remain active for a considerable time. Mustard gas may so remain for 12 to 48 hours or even longer in cool weather.

For gas shells, the best condition is calm, or with a wind of low velocity.

Gas projectiles can be used in all types of country.

Woods, tall grass, bushes, cornfields, and clumps of buildings may hold the gas active for a considerable time.

Several kinds of shell gas are used by the enemy :

Poisonous Shells : Immediate death. — The gases in some shells may cause instant death if a single breath is taken. These usually contain Hydrocyanic Acid (Prussic Acid) or an allied substance which causes death by action on the nervous system, paralyzing the respiration and resulting in convulsions, coma, and death. These are little used now.

Delayed death and delayed blindness. — Phosgene, chloropicrin, and mustard gas by destroying the lungs cause death from a few hours up to several days, especially if there has been any exertion after breathing the gas.

The new "Mustard Gas" (Di-chlor-ethyl-sulphide), after several hours, causes the eyelids to swell up so that sight is lost for one to four weeks with intense pain in the eyes; the skin is also burnt by it, though death is only caused by its action on the lungs.

Its danger lies in its insidious nature, because no appreciable irritation is caused at the time. It has a slight odor like mustard or garlic though even this smell may be disguised. The respirator and mask afford perfect protection against it.

Lachrymators. — These shells contain various substances of a nature irritating to the eyes, which makes them water and which causes immediate pain. While their immediate action is strongly irritant to the eyes, they may also cause a delayed general poisoning resulting in death. Respirators or masks must always be put on whenever an area is shelled by these missiles. Gas shells are occasionally sent alternately with High Explosive, the latter masking the presence of the former.

III. — Smoke.

11. The enemy may make use of smoke, either in the form of a cloud or emitted from shells and bombs. Smoke may be used with gas or between gas clouds; it may also be used alone to distract attention from a real discharge of gas, to cover the advance of infantry, or merely as a false gas attack.

IV. — Mine and explosion gases.

12. The poisonous gases which occur in mines, and which are formed in large quantities when high explosive goes off in an enclosed space (e. g., from a direct hit in a dugout, or from the explosion of a charge in a mine) are not protected against by the ordinary anti-gas appliances. The chief of these gases is carbon monoxide. Protection against such gases will not be considered in these notes.

II. — ORGANIZATION OF GAS DEFENSE.

13. Commanding Officers are held responsible that all the anti-gas appliances for protecting their men are maintained in perfect condition, and that all ranks under their command are thoroughly trained in the use of these appliances and in all other measures which may affect their safety against gas.

Summary of protective measures.

14. *a)* Respirators and masks for each man.

b) Inspection of respirators and masks and training in their use and instruction in all other measures of gas defense.

c) Protected and gas-proof shelters.

d) Weather observations to determine periods when the conditions are most favorable to a hostile gas attack.

e) Arrangement of signals and messages for immediate warning of a gas attack.

f) Appliances for clearing gas from trenches and shelters.

A. — ORGANIZATION OF ANTI-GAS DUTIES.

15. All ranks must be fully conversant with the measures to be adopted for defense against gas attacks as laid down in the Orders of their formation or unit (*).

A Chief Gas Officer is appointed in each Division, so that technical advice is readily available on all matters connected with gas defense. Apart from this, the following scheme of anti-gas duties should be adopted within units.

B. — ANTI-GAS DUTIES WITHIN AN INFANTRY REGIMENT.

(To be modified for other units to suit their organization and duties.)

16. The Commanding Officer will be directly responsible for all measures against gas attacks, and Company Commanders will be responsible to the C. O. for all anti-gas measures within their companies.

Regimental Gas Officer. — To aid the Regimental Commander in seeing that all anti-gas measures are efficiently carried out, Regimental Gas Officers are appointed on the Regimental commander's staff.

The special duties of the Regimental Gas Officer will be fully laid down in special instructions that will be issued from time to time by the Chief of the Gas Service.

In each Company one N. C. O., who has been trained at an Anti-Gas School, and who should be recommended by the Division Gas Officer as suitable for duty as "Company

(*) For typical Divisional Standing Orders, see Appendix IV

Gas N.C.O.", will be specially detailed to assist the Company Commander in anti-gas measures. At least one other similarly trained and recommended N.C.O. will be immediately available to take the place of the Gas N.C.O. in case of need.

A similarly trained Gas N.C.O. will be detailed to Battalion H. Q. for duty with H. Q. details.

17. The special duties of Gas N.C.O.'s will be definitely laid down in Regiments (*). Other duties may, however, be performed, provided that these do not interfere with the gas duties laid down.

18. In order to secure the necessary training in all matters pertaining to defense against gas attacks, the following officers and N.C.O.'s should attend a course at a Corps or other Anti-Gas School.

a) Officers.

1) The Commanding Officer or Second in Command, and the Medical Officer.

2) All Company Commanders.

3) Other Officers where possible.

b) N.C.O.'s.

1) Two per Company and 2 per Battalion H. Q.

2) Supplementary N.C.O.'s, to be trained whenever possible, so as to have a reserve from which to draw to replace Gas N.C.O.'s, in case of need.

The selected N.C.O.'s, who attend the Anti-Gas Schools will be reported on by the Officer in Charge as follows : At the end of the course the Director of the Gas School will, if the N.C.O. is, in his opinion, suitable for duty as "Company Gas N.C.O.", notify the C.O. concerned to this effect. The latter will then cause the words "passed Anti-Gas School" to be entered on his service record. Only N.C.O.'s, who have been thus reported on favorably should be detailed for duty as Company Gas N.C.O.'s.

19. C.O.'s will facilitate in every way the duties of the various officers of the Gas Service in visiting their lines and inspecting anti-gas arrangements, testing Strombos horn cylinders, etc. They should take every opportunity of consulting with officers of the Gas Service on all technical questions relating to anti-gas measures within their lines.

C. — PERSONAL ANTI-GAS EQUIPMENT.

I. — Equipment carried.

20. Each man is provided with a small box respirator and a mask. He must be made to realize that these appliances are personal equipment, that they are of importance second

(*) For typical Standing Orders for Company Gas N.C.O.'s, see Appendix V.

ENTRANCE TO GAS-PROOF DUGOUT

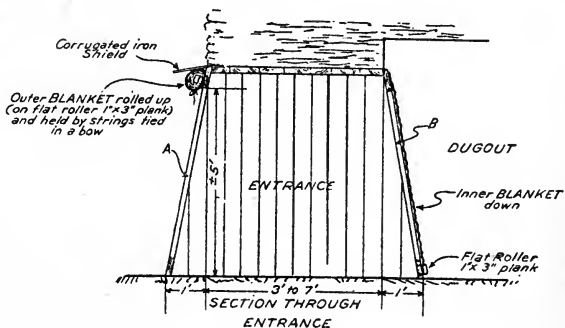
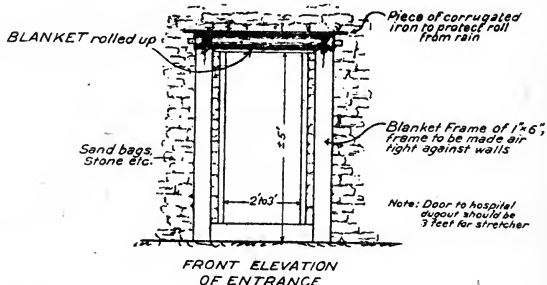


Fig. 1 and 2.

only to his weapons, and that his life may depend on looking after them and keeping them in good order.

21. The small box respirator is the most important protective apparatus. It is always to be used first in case of a gas attack, unless special orders are issued to the contrary. It will protect against all poisonous gases with the exception of mine and explosion gases, and will not become exhausted for hours, even in concentrations of gas generally unobtainable in the field.

22. The mask is an emergency or reserve defense. It is only to be used if the owner should not have a box respirator or if the latter should be found, for any reason, to be defective.

II. — When and where carried.

23. a) Both respirator and mask should be carried within 5 miles of the front line.

b) When the wind is safe, working parties during work and at the discretion of the officer in command, may take off their box respirators between 2 and 5 miles from the front line, provided they are placed conveniently at hand for use in case of a sudden gas shell attack or change of wind. The mask will always be carried.

c) At distances greater than 5 miles the mask only need be carried, the box respirator being kept with the equipment under arrangements by the C. O. of the Unit.

D. — PROTECTION OF SHELTERS.

I. — Methods of protection.

24. The fundamental principle to remember is that gas will follow the smallest current of air and make the dugout dangerous.

25. Conversely, if the entrances to the dugout are so arranged as to prevent air currents, the dugout remains safe for many hours even when there is a strong concentration of gas outside.

26. For these reasons, where tactically practicable, it is desirable to have only one entrance with double doors to each dugout, and no chimney.

27. If a chimney is necessary it must be so arranged that the stove pipe can be readily removed and the chimney opening quickly closed airtight. Great care should be taken in fitting this opening so that it will be air-tight, as otherwise well constructed dugouts are rendered unsafe. All entrances must be protected by double doors with an air space between. The best way of arranging such an entrance is shown in the diagram page 20.

a) The frames A and B made of 6" \times 1" planks, are fitted

to the entrance to the dugout at such a slope that the bottom of the frame is out about 1 foot for a height of 5 feet. Care must be taken in fitting in these frames to leave no cracks between the frame and the earth or the sandbags forming the sides or roof of the entrance.

b) Blanket cloth cut to the proper size is nailed to the top of the frame with a lath to prevent tearing. The blanket cloth must overlap the face of the frame by at least 3, and better still 6 inches.

c) A *flat* roller, made of 1 inch board about 3 inches wide is nailed to the bottom of the blanket on the outside so that when the blanket is unrolled it lies tight against the outside bottom part of the frame, but not touching the ground.

d) The frames of the inner and outer doors should not be less than 3 feet apart in order to allow a man to enter the air space and adjust the first blanket before passing through the second. For medical dugouts the air space should be 8 feet long and 3 feet wide to allow a stretcher to pass through.

e) It has been found useful to sew small metal weights along the sides of the curtain, which fall over strips nailed on the face of door-frame sides, top, and bottom. This causes the curtain to close more tightly.

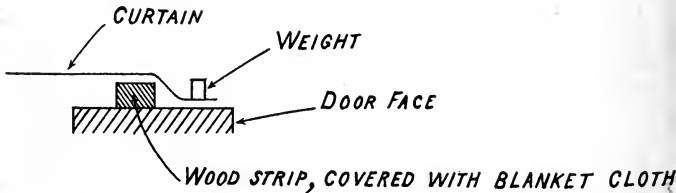


Fig. 3.

Another method for closing those dugouts that are not used during attack is to nail two strips along the face of the door and another to fit in the space between the two.

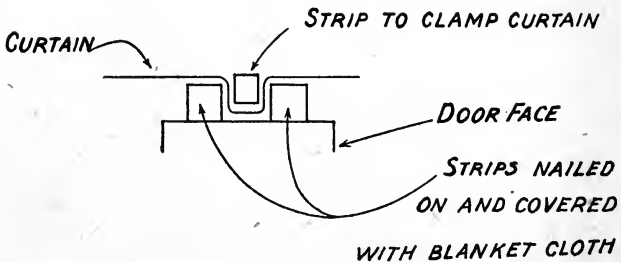


Fig. 4.

f) When not in use the blankets are to be kept rolled up and so held that they can be instantly released. For the outer door a piece of galvanized iron or other sheet metal is placed across the top of the doorway to protect the blanket from rain when it is rolled up.

g) To render blankets completely air tight they must be kept wet; therefore a Vermorel sprayer or a simple can of water should be kept in a special niche in the air space for moistening the blankets. Chemicals for neutralizing the gases are not necessary, but some substance like glycerine is good, as that tends to hold water and to absorb it from the air. Material wet with a solution of water and glycerine does not dry readily.

h) Men must pass through each doorway quickly, and immediately readjust the curtain before touching the second curtain.

i) On gas alarm being given, all fires in dugouts must be put out, the chimney opening closed *tight*, and the entrance curtains let down and sprayed. All persons in the dugout must be awakened and *all must put on their masks*, as some gas may leak in through faulty construction of the dugout, or by some one coming in with gas on his clothes.

II. — Shelters or dugouts which should be protected.

28. The following should always be protected with gas-proof entrances :

Medical aid-posts and advanced dressing stations, Company, Battalion, Regimental, and Brigade Headquarters, Signal Shelters, and any other place where work has to be carried out during a gas attack.

29. In addition to the above, it is desirable to protect all dugouts, cellars, and buildings within shell fire area, particularly those of artillery personnel. It should be noted, however, that the protection of dugouts for troops in the front line of trenches is usually inadvisable on account of the delay involved in getting men out in time of attack. It is desirable to protect stretcher bearers' dugouts with a view to putting casualties in them.

E. — PROTECTION OF WEAPONS AND EQUIPMENT.

30. Arms and ammunition and the metal parts of special equipment (e. g., telephone instruments) must be carefully protected against gas by oiling them or keeping them completely covered. Otherwise, particularly in damp weather, they may rust or corrode so badly as to refuse to act. A mineral oil must be used for this purpose. The following, in particular, should be protected :

I. — Small arms and small arms ammunition.

31. Machine guns and rifles must be kept carefully cleaned and well oiled. The effects of corrosion of ammunition are of even more importance than the direct effects of gas upon machine guns and rifles themselves.

Ammunition boxes must be kept closed. Vickers belts should be kept in their boxes until actually required for use. The wooden belt boxes are fairly gas-tight, but metal belt boxes should be made gas-tight by inserting strips of flannelette in the joint between the lid and the box.

Lewis magazines should be kept in some form of box, the joints of which are made as gas-tight as possible with flannelette.

A recess should be made, high up in the parapet if possible, for storing ammunition and guns. A blanket curtain, moistened with water or Vermorel sprayer solution, will greatly assist in keeping the gas out.

II. — Hand and rifle grenades.

32. Unboxed grenades should be kept covered as far as possible. All safety pins and working parts, especially those made of brass, should be kept oiled to prevent their setting from corrosion by the gas.

III. — Light trench mortars and their ammunition.

33. As far as the supply of oil permits, the bore and all bright-parts of light trench mortars and their spare parts should be kept permanently oiled. When not in use, mortars should be covered with sacking or similar material.

Unboxed ammunition should be kept covered as far as possible, and the bright parts oiled immediately after arrival. Ammunition which has been in store for some time should be used up first.

IV. — Guns, medium and heavy trench mortars, and their ammunition.

34. The protection of artillery and artillery ammunition is dealt with in par. 109.

V. — Signal equipment.

35. The protection of signal equipment is dealt with in par. 116.

F. — WIND OBSERVATION.

36. The Meteorological Service reports to Headquarters of Corps and Divisions whenever the wind passes into a dangerous quarter, showing the direction and strength of the wind. As a result of these reports, "Gas Alert" is ordered by Corps or Division H. Q. These general reports, however, refer to large tracts of country, and it is possible that on isolated lengths of front, conditions of terrain or the alignment of the trenches may permit of local air currents which are favorable to the enemy. It is essential, therefore, that the troops themselves should be on the look-out for the possibility of a gas attack.

The wind frequently changes its direction at night, thus creating conditions different from those existing in the day time.

The cooling of the air from midnight till dawn produces downward currents, and hence so far as air currents are concerned makes the period just before dawn the best for gas attacks.

A wind blowing down a steep slope into a valley tends to follow the direction of the valley and may thus be changed as much as 90 degrees in direction.

To make necessary wind observations, there should be a good wind station every $1\frac{1}{4}$ mile within 100 yards of the front line. Each should be so situated as to give conditions outside of trenches rather than inside but should not be close enough to headquarters to subject it to shell fire in case it is sighted by the enemy.

Observations have shown the wind to be mostly in our favor during the summer and fall and mostly in the enemy's favor during spring.

Company Commanders are responsible that wind observations are made on their Company front every three hours, or oftener if the wind is in, or approaching, a dangerous quarter, and the reports forwarded through the usual channels to Brigade H. Q. For the method of making these observations and preparing the reports, see Appendix V.

G. — THE GAS ALERT PERIOD.

I. — Order for gas alert.

37. Gas alert will be ordered when the wind is in the dangerous quarter, no matter what the strength of the wind.

The order "Gas Alert" will be sent out to all units by Corps H. Q. (or, if authority has been so delegated, by Division H. Q.), but Brigade or Regimental H. Q., or Battalion Commanders are empowered to order a "Gas

Alert" as a result of wind observations forwarded by Company Commanders. Such action will be reported immediately to the next higher formation.

Gas Alert notices should be posted at the entrance to each main communication trench and at other suitable points within Divisional Areas.

II. — Precautions during gas alert.

a) *Inspection.*

38. All box respirators and masks should be carefully inspected, and the inspection should be repeated daily. Steps must be taken to ascertain if all gas alarm appliances are in their positions and in good order.

b) *Alert position of respirators and masks.*

39. All ranks within two miles of the front line must carry their box respirators (or their masks, should they have no box respirators) in the alert position. The press buttons of the flap of the box respirator satchel must be unfastened.

During gas alert the chin strap of the steel helmet must be worn on the point and not under the chin, as it will impede the rapid adjustment of the respirator or mask.

c) *Sentries, etc.*

40. A sentry should be posted at each Strombos horn or other alarm device and instructed in its use, and all working parties should have a sentry posted to give instant warning of a gas attack.

A sentry should also be posted at every large shelter or group of small shelters and at each Headquarters, Signal Office, and independent body of men.

Arrangements must be made by the officer in charge of the trench for warning the Artillery Observation Post if there is one in the trench.

Commanders of units in billets within 8 miles of the front line trenches must organize a system of giving the alarm and rousing all men in cellars or houses.

At night sentries should have at least two men within reach of them, so that the alarm can be spread rapidly.

d) *Sleeping.*

41. When a gas attack is probable, men in front line trenches should sleep on the fire step instead of in dugouts. Men sleeping in rearward lines, or in works where they are allowed to take off their equipment, must sleep with their box respirators on the person.

e) *Company Gas N. C. O.'s.*

42. Company Gas N. C. O.'s will report to Company

H. Q. in readiness to assist the Company Commander should a gas attack occur.

f) Officers and N. C. O.'s.

43. Officers and N. C. O.'s in command of any unit or party must see that the above orders are strictly carried out, both for troops in front line trenches and for detached bodies of troops (working and carrying parties, etc.).

III. — Removal of gas alert.

44. Gas alert will not be taken off without the authority of the Corps Commander or the Division Commander to whom authority has been delegated.

On the receipt of orders for the removal of gas alert, the notices on the subject will be amended accordingly.

H. — CLOUD GAS ALARM.

I. — Method of giving the alarm.

45. For the purpose of giving the alarm the Strombos horn, which is audible for very long distances, is the most important appliance. Its main use is for conveying the alarm to troops in support and reserve lines. In addition, some local appliance, such as a gong or suspended rail, must be fastened up at every sentry's post for the purpose of rousing the men in the immediate vicinity and for conveying the alarm to the sentries in charge of the strombos horns.

Strombos horns should be in the front line, at intervals ordinarily not greater than 400 yards, and at such other points behind the front as required to ensure transmission of warning. As much use as possible should be made of the telephone for transmitting the gas alarm, though it can not be relied upon owing to the possibility of its breaking down.

No reliance can be placed on methods of giving the alarm involving the use of the lungs; e. g., bugles or whistles.

46. Sentries must be prepared to give the alarm on the first appearance of gas, as a few seconds delay may involve very serious consequences. Signals must be passed along by all sentries as soon as heard.

The earliest warning of a gas cloud attack is generally given:

- a) By the noise of the gas escaping from the cylinders
- b) By the appearance of a cloud of any color over the enemy's trenches. If the attack takes place at night, the cloud will not be visible from a distance.
- c) By the smell of the gas in listening posts.

II. — Action to be taken in the trenches on gas alarm.

47. a) *Respirators* to be put on immediately by all ranks (mask, if no box respirator is available).

b) *Rouse* all men in trenches, dugouts and mine shafts, warn officers and artillery observation posts and all working men.

c) *Artillery support* to be called for by Company Commanders, by means of prearranged signals.

d) *Warn* Battalion H. Q. and troops in rear.

e) *All ranks stand to arms* in the front trenches and elsewhere where the tactical situation demands.

f) *Blanket curtains* at entrances to protected shelters to be let down, carefully fixed, and wet with water or chemical solutions.

g) *Movement* to cease except where necessary.

III. — Action to be taken in billets and back areas.

48. a) All men in cellars or houses to be roused.

b) The blanket curtains of protected cellars, etc., to be let down, fixed in position, and sprinkled.

c) Box respirators to be put on immediately the gas is apparent.

I. — ACTION DURING A CLOUD GAS ATTACK.

I. — Protective measures.

49. There should be as little moving about and talking as possible in the trenches. Men must be made to realize that with the gas now used by the enemy, observance of this may be essential for their safety.

When an attack is in progress, all bodies of troops or transport on the move should halt and all working parties cease work until the gas cloud has passed.

If a relief is going on, units should stand fast as far as possible until the gas cloud has passed.

Supports and parties bringing up bombs should only be moved up if the tactical situation demands it.

50. If troops in support or reserve lines of trenches remain in, or go into, dugouts, they must continue to wear their anti-gas appliances.

Officers and N. C. O.'s must on no account remove or open up the masks of the box respirators or raise their masks to give orders. The breathing tube may be removed from the mouth when it is necessary to speak, but it must be replaced before drawing breath.

51. Men must always be on the look-out to help each other in case a box respirator or mask is damaged by fire or accident. When a man is wounded, he must be watched to see that he does not remove his respirator or mask until he is safely inside a protected shelter; if necessary, his hands should be tied.

Men must be warned that if they are slightly gassed before adjusting their respirators or masks they must not remove them.

II. — Tactical measures.

52. From the point of view of protection against gas, nothing is gained by men remaining in unprotected dugouts or by moving to a flank or to the rear. It is, therefore, desirable that on tactical and disciplinary grounds all men in the front line of trenches should be forbidden to do these things. In support or reserve lines, where there are protected dugouts, it is advisable for men to stay in them unless the tactical situation makes it desirable for them to come out.

54. Nothing is gained by opening rapid rifle fire unless the enemy's infantry attacks. A slow rate of fire from rifles and occasional short bursts of fire from machine guns will lessen the chance of their jamming from the action of the gas and tends to occupy and steady the infantry.

55. It should be remembered that the enemy's infantry cannot attack while the gas discharge is in progress and is unlikely to do so for an appreciable time — at least 10 minutes — after it has ceased. It is, in fact, a common practice for the enemy infantry to retire to the second and third line of trench whilst gas is being discharged. There is, therefore, no object in opening an intense S.O.S. barrage of artillery on "No man's land" during the actual gas cloud and it is advisable that the warning to the Artillery of a gas attack should be a signal differing from the ordinary S.O.S. signal, as the latter may have to be sent later if an infantry attack develops.

56. It must be remembered that smoke may be used by the enemy at the same time as, or alternately with, the gas and that under cover of a smoke cloud he may send out assaulting or raiding parties. A careful look-out must, therefore, be kept; hostile patrols or raiders may be frustrated by cross-fire of rifles and machine guns and should an assault develop the ordinary S.O.S. procedure should be carried out.

J. — PRECAUTIONS AGAINST GAS SHELLS.

57. When gas is smelt men may not realize its possibly dangerous character at once and so may delay putting on respirators or masks until too late. Men sleeping in dugouts may be seriously affected unless they are roused. The following points should therefore be attended to :

58. 1) All shells which explode with a small detonation or appear to be blind should be regarded with particular attention, though all shell should be suspected of carrying gas; the respirator or mask should be put on at the first indication of gas, and blanket protection of shelters adjusted.

2) Arrangements must be made for giving a local alarm with klaxons, etc., in the event of a bombardment with poison gas shells, but Strombos horns must on no account be used to give warning of a gas shell bombardment.

3) All shelters in the vicinity of an area bombarded with poison gas shells must be visited and any sleeping men roused.

4) Box respirators or masks should continue to be worn throughout the area bombarded with poison gas shells until the order is given by the local unit Commander for their removal.

59. Lachrymatory or "tear" shells are frequently used by the enemy for the purpose of hindering the movements of troops, for preventing the bringing up of supports, or for interfering with the action of artillery.

Owing to the deadly nature of poison gas shells, however, the precautions given in par. 58 above must be taken for all shells, until certain no gas shells are being used.

K. — PRECAUTIONS TO BE TAKEN WITH REGARD TO OUR OWN USE OF GAS IN CYLINDERS, BOMBS, ETC.

60. Protection of troops is necessary during our own gas attacks. Adequate protective measures should always be possible, as arrangements can be made in advance and the element of surprise can be excluded. The following points should be noted :

I. — Handling gas cylinders.

61. Men engaged in carrying or digging-in gas cylinders should carry their box respirators in the "Alert" position.

II. — Action when gas cylinders are in position in trenches.

62. a) Box respirators should be carried in the "Alert" position by troops in front line trenches.

b) If a cylinder is burst by shell-fire, men should retire upwind for a short distance, if possible. Dugouts in the neighborhood of the burst must be evacuated at once.

III. — Action during our gas attacks.

63. a) It is advisable that all troops, except those whose presence is considered absolutely necessary, should be withdrawn from the front trench before gas is discharged. Any officer or man who has special orders to remain must *wear* his box respirator.

b) All troops in any part of the front line within half a mile of the nearest point where gas is being discharged must *wear* their box respirators.

c) If troops advance after a cloud gas attack has been made, it must be remembered that the gas may hang about for a considerable time in long grass, shell holes, and hollows, and for several hours in the enemy's dugouts and shelters. Raiding or reconnoitering parties after a gas discharge should carry their respirators in the Alert position. *Dugouts should not be occupied* until they have been thoroughly ventilated and the *absence of gas established*. This is equally necessary with regard to shelters which have been penetrated by gas from shells or bombs.

IV. — Gas bombs and grenades.

64. These may, if necessary, be stored with other ammunition. In the event of leakage they should be buried in the ground 3 1/2 feet deep. They should not be thrown into water. All rescue work and disposal of leaky shells should be carried out by men wearing box respirators and gloves.

L. — ACTION AFTER A CLOUD GAS ATTACK.

I. — General.

65. The most important measure to be taken after a cloud gas attack is to prepare for a further attack. The enemy frequently sends several successive waves of gas at intervals varying from a few minutes up to several hours, and it is therefore necessary to be on the alert to combat this procedure. The following measures should be adopted as soon as the gas cloud has passed :

a) *Removal of respirators.* — Anti-gas fans should be used to assist in clearing the trenches of gas, so as to admit of respirators being removed. Box respirators and masks must not be removed until permission has been given by the Company Commander, who will, when possible, ascertain from officers and N. C. O.'s who have been trained at a Gas School that it is safe to do so.

b) *Return to the Alert position.* — After removal of respirators in order to be ready for a subsequent attack, box respirators and masks must be put back in the Alert position.

A sharp look-out must be kept for a repetition of the gas attack, as long as the wind continues in a dangerous quarter.

II. — Movement.

66. Owing to the enemy gas sometimes causing bad after-effects, which are intensified by any exertion, the following points should be attended to :

a) No man suffering from the effects of gas, however slightly, should be allowed to walk to the dressing station.

b) The clearing of the trenches and dugouts should not be carried out by men who have been affected by the gas.

c) After a gas attack, troops in the front trenches should be relieved of all fatigue and carrying work for 24 hours by sending up working parties from companies in rear.

d) Horses which have been exposed to the gas should not be worked for 24 hours if it can be avoided.

III. — Clearing dugouts and other shelters.

67. It is essential that no dugout be entered after a gas attack, except with box respirators or masks adjusted, until it has been ascertained that it is free from gas. The only efficient method of clearing dugouts from gas is by thorough ventilation. The older method of spraying is not efficient.

An appreciable quantity of gas may be retained in the clothing of men exposed to gas attacks and also in bedding, coats, etc., left in shelters. Precautions should, therefore, be taken to air all clothing.

a) *Ventilation.*

68. *Natural Ventilation.* — Unless a shelter has been thoroughly ventilated by artificial means, as described below, it must not be slept in, or occupied without wearing respirators, until at least 12 hours have elapsed. It must not be entered at all without respirators on for at least 3 hours. The above refers to cloud gas attacks. In the case of gas shell bombardments the times cannot be definitely stated, as they depend on the nature of the gas used and the severity of the bombardment. With lachrymatory gases or mustard gas the times after which shelters can be used without discomfort may be much longer than those mentioned above.

69. Ventilation by Fire. — All kinds of shelters can be efficiently and rapidly cleared of gas by the use of fires. Shelters with two openings are the easiest to ventilate but most difficult to protect.

In dugouts provided with a single exit at the end of a short passage, the best results are obtained if the fire is placed in the centre of the floor of the dugout and at a height of about 6 inches.

In dugouts provided with a single exit at the end of a long and nearly-horizontal passage, the best results are obtained if the fire is placed in the dugout about one-third of the distance from the inner end of the passage.

In dugouts provided with two or more exits, the fire should be placed at the inner end of one of the exit passages away from the direction of the wind in order to give a good draft through the dugout.

70. In general, 1 lb., of dry wood per 100 cubic feet of air space is sufficient for clearance of any gas. The best fuel is split wood, but any fuel which does not smoulder or give off thick smoke can be used. The materials for the fire, e. g., the split wood, newspaper, and a small bottle of kerosene for lighting purposes, should be kept in a sandbag enclosed in a tin box provided with a lid. An improvised stove should be kept ready for use.

The fire must be kept burning for at least 15 minutes and the atmosphere in the shelter should be tested from time to time.

If mustard gas or a similar one with very high boiling point should burst so as to scatter liquid gas in the dugout, ventilation alone is not sufficient. In order to be safe under 2 to 3 days the liquid would have to be thoroughly treated with chloride of lime.

71. Ventilation by Fanning. — Dugouts can be ventilated by producing air currents in them by means of special anti-gas fans. A full description of the anti-gas fan and the method of using it to clear gas from trenches and shelters is given later (see par. 96-100).

If no anti-gas fans are available, ventilation can be assisted by flapping with improvised fans such as sandbags, blankets, etc.

b) Sprayers.

72. Vermorel sprayers will not clear gas from trenches. The solution has very little effect on phosgene, and even with the addition of other chemicals it cannot be relied upon to remove gas from the air. Vermorel sprayers are only for wetting blankets on doors of dugouts.

IV. — Cleaning of arms and ammunition.

73. Rifles and machine guns must be cleaned after a gas attack and then re-oiled. Oil cleaning will prevent corrosion for 12 hours or more, but the first available opportunity must be taken to dismantle machine guns and clean all parts in boiling water containing a little soda. If this is not done, corrosion continues slowly even after oil cleaning and may ultimately put the gun out of action.

After a gas attack, small arms ammunition should be carefully examined. All rounds affected by gas must be replaced by new cartridges immediately and the old ones cleaned and expended as soon as possible.

74. All hand and rifle grenades exposed to the gas should have their safety-pins and working parts cleaned and re-oiled.

75. All bright parts of light trench mortars, together with all accessories and spare parts exposed to the gas, must be cleaned and wiped dry as soon as possible after the attack, and in any case within 24 hours, after which they should be thoroughly coated afresh with oil. The same applies to ammunition which may have been exposed to the gas.

Ammunition which, for any reason, had not been oiled, must be cleaned and oiled and fired as soon as possible.

For details regarding the cleaning of guns and artillery ammunition and signal equipment, see par. 109 and 116.

V. — Treatment of shell holes.

76. In the neighborhood of shelters or battery positions where gas from shell holes is causing annoyance, the holes and the ground round them should be covered with at least a foot of fresh earth or a quarter of an inch of chloride of lime. Shell holes covered with earth should not be disturbed, as the chemical is not thereby destroyed and only disappears slowly. This is particularly true of mustard gas.

III. — PROTECTIVE APPLIANCES.

A. — INDIVIDUAL PROTECTIVE APPARATUS.

I. — Box respirator.

a) *Description.*

77. The box respirator consists of a box packed with chemicals and connected by means of a flexible rubber tube to an impervious face piece or mask. The inspired air enters through a valve in the bottom of the box; the expired air is expelled through a valve just outside the face-piece. The wearer breathes in and out through a mouthpiece inside the mask, breathing through the nose being prevented by a nose-clip inserted in the face piece. The latter is made of gas-proof fabric and is arranged to fit the face closely, being held in position by two elastic bands. As it encloses the eyes, the mask is fitted with two eyepieces which allow a wide field of vision. These should be treated with anti-dimming composition, but if necessary they can be cleaned without removing the respirator, by means of folds in the material. The mouth-piece can be removed from the mouth to enable the wearer to speak without disturbing the fit of the mask. The complete respirator is carried in a special satchel which is divided into two compartments, one of which holds the box and the other the mask. The box rests on a metal saddle which raises it from the bottom of the satchel and allows the free access to air.

b) *Personal Fitting.*

78. It is necessary that each man should have a box respirator, the mask of which properly fits his face. For this reason the face pieces are made in six sizes, four of which are regular issues and the other two are obtained on special requisition. The various sizes will be needed probably in the following proportions :

No. 0. Extra small	0.1 % (Special requisition)
No. 1. Very small	0.3 %
No. 2. Small.	3.0 %
No. 3. Medium.	75.0 %
No. 4. Large.	15.0 %
No. 5. Extra large	2.0 %

The fit of each man's mask must be inspected and then tested in a gas chamber. Almost any room which can be closed up tightly may be used for this purpose, but the most suitable arrangement is to have a double door or a door and

a curtain, similar to the protected dugouts, so that as little of the gas as possible escapes into the outer air. A still better arrangement is to use two adjoining rooms, the inner of which is the actual gas chamber. A small quantity of lachrymatory liquid is sprayed into the room, and the man enters, wearing his box respirator. He must remain in the room five minutes and move about and talk. If the mask does not fit, lachrymation quickly ensues and the man retires. He should then be examined to see whether the lack of fit is due to bad adjustment or to his having a wrong size of mask. In the latter case, a different size must be issued and the test repeated.

The fitting and adjusting of masks cannot be too thoroughly carried out. Special attention must be paid to the fitting of the mask and nose-clip with men who wear spectacles.

c) Method of Use.

79. The satchel containing the box respirator is carried outside all other equipment. When away from the trenches, it may be worn slung over the right shoulder, but men in the trenches or proceeding thither must carry it slung on the chest in the "Alert" position. The flap of the satchel with the press buttons must always be towards the body, but the press buttons must be kept fastened, except during the actual "Gas alert". The method of wearing the box respirator and of putting it on from the "Alert" position are fully described in Appendix I. It is important that the methods therein described should be practised by all who are equipped with the box respirator, to ensure rapidity in adjustment and proper care in its use.

80. Men with perforated ear drums may be affected by the gas penetrating through the ear passages to the respiratory organs and causing irritation there. In these cases it is useful to plug the ears with wadding. C. O.'s should ascertain from the Medical Officers in charge of their units the names of those suffering from this disability in order that the above precaution may be taken.

81. It must be remembered that the box respirator can be worn in gas for many hours without losing its efficiency or causing any distress. It may be breathed through in drills for a period of an hour per week for 40 weeks when it should be turned in. This permits a drill period of at least an hour per week.

d) Replacement. Record of Use.

82. The correct keeping of records as to hours of use of the box respirator, by entries in the small book forming part of the repair outfit, is a matter of the greatest importance, as these records form the only guide as to whether the boxes should or should not be replaced. Decision as to replace

ment should be made on the advice of the Chief Gas Officer of the Division. The approximate time of actually breathing through the box should be noted. These entries must always be made after drills and gas attacks, great care being taken that they are correct.

e) *Inspection.*

83. Box respirators must be normally inspected once a week and daily during "Gas Alert".

It is of the utmost importance that the inspection should be carried out regularly and with the greatest care. Any neglect in doing this may lead to loss of life.

The points to be attended to will be found in Appendix II.

f) *Anti-Dimming Composition.*

84. At the weekly inspection and after every time the respirator is worn, the composition provided for the purpose will be put on the eyepieces in the manner described in Appendix II.

g) *Local Repairs.*

85. A small repair outfit, consisting of pieces of adhesive plaster is included, with a record card, in each satchel.

Small perforations in the face-pieces can be made good by applying pieces of the adhesive plaster to the perforation, both inside and outside the mask. They should be large enough to overlap the hole all round. Box respirators so repaired should be exchanged as soon as possible. The repair is only intended to make them safe until a new respirator can be obtained.

No other local repairs are permitted and all defective respirators must be handed in and new ones obtained.

Box respirators which have fallen into water must be exchanged as soon as possible.

II. — The mask.

a) *General.*

86. The mask is the reserve defence against a gas attack and great care must be taken by officers to insure that it is in good order and that men have been trained in its use.

b) *Sizes and proportion of each.*

The mask is made in 3 sizes and the proportion of each size which will be needed for issue to a command is approximately as follows.

Small	3 %.
Medium	87 %.
Large	10 %.

The main point to be impressed on the men is that the

chemically treated material of the mask acts as a filter and that all air breathed into the lungs must pass through the gauze.

The mask is therefore useless unless properly adjusted so that no air may pass in around the edges. During its passage through the material of the mask all poisonous gas is absorbed by the chemicals.

The mask must be preserved from wet and should be removed from its container only for inspection and drill.

Every man should shave at least once a day, as a heavy growth of beard may permit the entrance of sufficient gas to injure a man seriously. For the same reason the hair should be kept short enough to nowhere catch under the edges of the mask.

c) Manner of Carrying.

The mask should be worn over the left shoulder and should hang on the right side. It should be hung in position before the Box Respirator is hung on in order that the strap of the mask may not interfere with the ready adjustment of the respirator in the alert position.

d) Drill.

Mask drill should be carried out frequently by all ranks. It should aim at teaching the quick adjustment of masks under all conditions, accustoming the men to wear them for a long time and to exercise in them. Drill must be carried out both with and without overcoats and equipment, and by night as well as by day.

For details of drill, see Appendix I.

e) Inspection of Masks.

87. Masks should be inspected once a week and daily during "Gas Alert". It is of the utmost importance that this inspection should be carried out regularly and with the greatest care. Any neglect in doing this may lead to loss of life.

The points to be attended to will be found in Appendix II.

f) Replacement.

88. Masks will be withdrawn as follows :

- 1) After any gas cloud attack in which the mask was worn ;
- 2) After a total of 6 hours use for any purpose.

III. — Horse respirators.

89. A full description of the British type Horse Respirator and the method of using it is given in Appendix III.

B. — ANTI-GAS APPLIANCES FOR GENERAL USE.

I. — Strombos horns.

a) *General.*

90. The experience gained in recent gas attacks has shown that Strombos Horns are the most effective form of gas alarm appliance and are audible for very long distances.

b) *Description.*

91. Each horn is issued in a box containing one horn, two compressed-air cylinders, one length of rubber tubing with screw connections, one screwdriver, one gimlet and one adjustable spanner. One spare cylinder is issued with the horn, to be kept at the Division or Brigade H. Q. to replace used cylinders without delay. A reserve of charged cylinders is also kept at the Corps workshop.

c) *Method of Use.*

92. The horn should be mounted in a horizontal position by screwing to the outside of the case or to some other suitable support and must be protected as much as possible from rain or shell splinters. Should it be necessary to change its position, the horn should be fixed in the box by means of the butterfly nuts provided. Strombos horns must always be ready for use, the horn being connected to one of the compressed-air cylinders by the rubber tube. The union joints at both ends of the tube must be tight. The horn should be pointed toward the rear.

93. To sound the horn, unscrew the screwcap on the air cylinder two complete turns. The horn will sound for about one minute.

Immediately after use, couple up the horn to the second air cylinder and leave it ready for use in case of a second gas cloud. The used cylinder should be clearly marked Empty and replaced as soon as possible from the reserve.

d) *Replacement and Repair.*

94. The pressure of the cylinders will be tested under arrangements made by the Chief Gas Officer of the Division once every week, and defective ones returned for re-charging.

On no account is any adjustment of the horn to be attempted except by the Chief Gas Officer of the Division or trained N.C.O.'s. A horn will be thrown completely out of action by movement of any of its parts.

Damaged horns must be sent to the workshop for repairs.

II. — Other gas alarm devices.

95. No definite pattern has been adopted for secondary alarm devices suitable for installing at every sentry post. Bells, gongs (shell cases), suspended rails, and other appliances are all in use, but single bells and gongs are generally too weak, and all of these arrangements suffer from requiring the use of a man's hands.

A very suitable arrangement as an alarm is a triangle of light steel rail, mounted in such a way that it can be beaten by working a treadle. It can thus be sounded by a sentry while he is putting on his respirator or mask. Similar devices not requiring the use of the hands should be devised and installed where possible.

III. — Anti-gas fans.

96. The Anti-gas Fan consists of a sheet of canvas supported by braces of cane and reinforced in the middle. It is made with two transverse hinges and is fitted with a hickory handle. The flapping portion is roughly 15 inches square and the handle is 2 feet long.

Method of Use.

a) *Clearing Trenches.*

97. The fan blade is placed on the ground with the brace side downwards, the man using it being in a slightly crouching position with the left foot advanced, the right hand grasping the handle at the neck and the left hand near the butt end. The fan is brought up quickly over the right shoulder and then smartly flicked to the ground with a quick slapping stroke. This drives a current of air along the earth and, on the top strokes, throws the gas out of the trench as it were by a shovel.

It is essential that the part of the fan blade nearest the handle should touch the ground first, and this can be accomplished in all cases by ending the stroke with the whole length of the handle as close to the ground as possible.

98. In working round a traverse, etc., the fan should be flapped round the corner with the hinge on the corner and the lower edge of the fan as near the bottom of the trench as can be managed. The brace side of the fan is to be outwards and at the end of the stroke the whole length of the handle should be close up to the side of the trench.

If several fans are available, men should work in single file and with "out-of-step" strokes, i. e., one fan should be up while the next is down.

b) *Clearing Shelters.*

99. In the case of a dugout with a single entrance not exceeding 12 feet in length, the gas is first cleared from the neighborhood of the shelter as in 97, and then the corners worked round as in 98. The worker now advances to the inner end of the entrance, beating rather slowly on the ground to allow the gas time to get out of the tunnel and bringing the fan as near the roof as possible on the return stroke. This makes an overhead current outward with a floor current inward.

It may be desirable to have a second fan working just outside the dugout to throw the gas out of the trench as it comes out.

In the case of dugouts with two entrances or with one entrance and another opening, such as a chimney, it is only necessary to use the fan round the corner of one entrance in the manner described in 98. When the entrance is cleared, it is advisable to enter the shelter with a respirator on in order to beat up the gas from the floor boards, etc. This greatly facilitates the removal of the last traces of gas.

**Special methods to be used after shelling with
"Mustard gas" (Dichlorethylsulphide).**

100. a) Mustard gas is very persistent and will render an area shelled with it dangerous for as long as two days.

b) Therefore, dugouts and shelters into which gas has penetrated or has been carried by clothing after a severe shelling with mustard gas should, if practicable, be temporarily evacuated, as it is very hard to clear the gas from dugouts. Those that remain in the shelled areas or dugouts must wear their respirators continuously.

c) Occupants of entire dugouts have been gassed from two or three men, who, having been exposed to the gas, had entered the dugouts.

d) Doctors have been gassed while attending gassed cases. For these reasons, it is imperative to remove entirely the clothing of gassed cases. The patient must, however, be at once reclothed with warm clothing or covered well with unaffected blankets, as chilling of the patient must be avoided by all means. Clothing must be washed in pure water for at least an hour then dried in the open. Temperature of the water should not exceed 80° C.

e) Chloride of lime freely spread on the ground destroys the gas. If not enough is used, the gas near the surface is destroyed but that which soaked in is not. Hence ground so treated should not be again dug up. Men have been gassed from digging around "mustard" areas without wearing masks. Mustard gas shells should only be handled by men wearing masks and gloves.

f) Fresh earth may be used to cover up shell holes and areas affected by liquid mustard gas, but the respirator must be worn by the workmen while doing so.

IV. — Vermorel Sprayers.

101. Vermorel sprayers are withdrawn from general use for clearing out gas after an attack, but a certain number are retained for moistening the blankets of protected shelters and for use in medical dugouts. They should be kept for this purpose only, and on no account relied on for clearing trenches or shelters of gas.

102. Company Vermorel Sprayers. — Sprayers on the basis of two per Company are retained for moistening blankets in the blanket protected dugouts. They should be kept by Company Gas N. C. O.'s with other anti-gas trench stores, and should be kept one-third full of water. The solution must be kept in corked jars or other closed receptacles close to each sprayer. The liquid should not be kept in the sprayers owing to its corrosive nature. It is made up as follows :

Water, 3 gallons (one large bucket).

Sodium Thiosulphate (hypo.), 1 1/2 lbs.

Sodium Carbonate (washing soda), 3 lbs.

The necessity for keeping corked the receptacles holding the solution must be impressed on the personnel responsible for it.

When no solution is obtainable, water may be used for spraying the blankets.

V. — Gas sampling apparatus.

103. It is desirable that samples be obtained of the enemy gas used in attacks, especially cloud gas attacks. For this purpose two kinds of appliances are kept in the trenches, viz., Vacuum Bulbs and Gas-Testing Tubes. These should be looked after by the Company Gas N. C. O.'s whose duty it is to take the samples, but officers should take all possible steps to ensure that samples of the gas are actually taken, as the information obtained may be of the greatest importance.

Full details of the methods of taking samples are laid down in "Instructions for taking Gas Samples, etc." (Appendix VI).

IV. — CONSIDERATIONS AFFECTING SPECIAL ARMS.

104. The foregoing notes apply to all arms and are complete as regards considerations of gas defense affecting troops in trenches generally. Additional information for the guidance of other arms on anti-gas measures which affect them specially is given below.

A. — CAVALRY.

105. It is unlikely that Cavalry, when mounted, will encounter high concentrations of gas from a gas cloud, or even from gas shells. It will probably be found, therefore, that, when acting as mounted troops, the mask will be adequate protection, besides being less cumbersome than the respirator.

106. On the other hand, Cavalry used to supplement Infantry in the line, or employed as working parties in or near the trenches, must be equipped for gas defense in the same way as the infantry.

B. — ARTILLERY.

I. — General.

107. Artillery are as liable if not more so than anyone else to bombardment with gas shells, both poisonous and lachrymatory. Owing to the suddenness of shell attacks and the long period that the neighborhood of a battery may be affected by lachrymators or mustard gas, it is essential that the following points be noted :

a) Where, owing to circumstances, box respirators are not actually worn on the men, they must be hung separately and within easy reach of the owners. If this course has to be adopted, the respirators should be ready prepared with the haversack sling shortened by means of the tab and stud and the slack of the sling tucked under the mask as in the "Alert" position. The satchel flap should be unbuttoned, but kept in position. (Respirators should not, if possible, be hung in the actual gun emplacements, owing to the concussion being liable to displace the chemicals in the box.)

Men must be thoroughly practiced in getting their respirators on in the shortest possible time when they are stored in this manner.

The mask will, in any case, always be carried on the man for use in case of emergency.

b) Men must be well practiced in wearing their box respirators for long periods and in serving their guns while wearing respirators or masks.

II. — Forward observing parties.

108. Forward observing parties must take all the precautions previously laid down for Infantry.

III. — Preservation of guns and ammunition.

109. The following precautions apply to medium and heavy trench mortars as well as to guns and howitzers :

a) *Protection.*

Batteries which are in constant danger of gas attacks, whether from gas clouds or gas shells, should keep all bright parts of their guns or mortars, carriages, mountings, and accessories well coated with oil.

Sights and all instruments should also be smeared with oil and protected with covers when not in actual use, care being taken that the oil does not come in contact with any glass or find its way into the interior of the instrument.

Cartridge cases of ammunition stored with the Battery and all uncapped fuses, or fuses which have been removed from their cylinders, should be wiped over with oil as soon as possible and protected with a cover.

b) *Cleaning.*

All bright parts of guns and trench mortars, together with all accessories and spare parts exposed to the gas, must be cleaned and wiped dry as soon as possible after the attack, and in any case within 24 hours, after which they should be thoroughly coated afresh with oil.

The same applies to the whole of the ammunition still in the Battery position. Ammunition which, for any reason, had not been oiled, must be cleaned and oiled. It is desirable to expend it as soon as possible.

IV. — Aiming points and aiming posts.

110. Aiming points and aiming posts are liable to be obscured by the gas cloud and arrangements should, therefore, be made in every Battery to meet this eventuality by providing gun-pits with means to check the line of fire if necessary, without depending on the use of aiming posts.

V. — Tactical measures during a gas attack.

111. Enemy gas attacks may be executed for purposes

other than the preparation of a subsequent infantry attack. During the gas discharge a heavy artillery fire on the actual trenches whence the gas is issuing is the best way of dealing with the situation. Also it is essential that the gas discharge should be interfered with as early as possible, as the opening periods of the discharge are the most effective.

112. To ensure an effective and immediate artillery fire the following points require attention :

a) Certain howitzer Batteries should be detailed to open a rapid fire for a short time as an anti-gas measure.

b) Only certain portions of the enemy's front trenches can be used for gas discharge in any given wind and these can easily be indicated on any accurate trench map. Each Battery charged with the task of hampering an enemy gas attack should be provided with a map and a table, showing from what portions of the enemy's lines (within the Battery's zone of action) gas can be discharged in any given wind.

113. Nothing in the foregoing paragraphs in any way affects the responsibility of artillery for dealing with any infantry attack, or for the execution of counter-battery work.

C. — TUNNELLING COMPANIES.

114. I) Tunnelling companies are again reminded that neither the box respirator nor the mask affords protection against mine or explosion gases. Oxygen breathing sets have been used with good results.

II) Owing to the difficulty in clearing gas, especially lachrymatory gas, from mine-shafts and galleries, the entrances to mine-shafts should be protected from gas by blanket curtains in the manner already described for dug-outs.

III) The enemy has occasionally attempted to render galleries untenable by the use of gas bombs in conjunction with the explosion of a charge. If this is done, the box respirator must be worn if work has to be continued.

D. — SIGNAL SERVICE AND TELEPHONE OPERATORS.

I. — General.

115. It is essential that telephone and other signal operators should be able to work as much as possible during a gas attack without wearing respirators or masks. Signal dugouts must, therefore, be particularly well protected against gas, so as to allow this to be done.

II) Telephone and other signal operators must be specially trained in using their instruments when wearing box respirators, masks, or such other gas masks as may be furnished them. It may be necessary to rely on the fuller-phone or buzzer when gas equipment is being worn on account of the difficulty of speaking with the mask on. Special telephone transmitters are being designed, which will overcome this difficulty.

III) Linemen and signal men in general must receive plenty of practice in carrying on their work, both by day and by night, while wearing respirators and masks.

II. — Preservation of signal equipment.

a) *Protection of Instruments and Apparatus.*

116. The only effective method of preventing corrosion of electrical and other apparatus during a gas attack is to prevent the gas reaching it, and the best way of doing this is to have Signal Shelters and Offices thoroughly protected against gas. As the corrosive effect is very much greater on instruments if they are damp, the shelters should be kept as dry as possible. Instruments and apparatus which have to be used in the open will be less affected if kept perfectly dry.

The cases and covers of all instruments and apparatus must be made as nearly gastight as possible. The varnish and paint protection applied to the metal parts and coils must be carefully preserved. All apparatus, such as telephones, test boards, connecting frames, spare instruments, etc., which it is not essential to have uncovered should be well covered up with cloths, blankets, or spare clothing. A heavy mineral oil such as Cosmic may be used on metal parts and, in fact, on all articles which will not be injured by the oil, though great care must be taken to keep it off electrical contacts. Unless actually required for use, signal lamps must be closed and preferably packed, with accessories, in the carrying cases. Fireworks are, in general, little affected by gas if the moistureproof varnish has not been cracked or broken.

b) *Cleaning Instruments after a Gas Attack.*

117. After a gas attack, electrical apparatus that has been exposed to gas should be treated as follows :

The ends of all leading in wires should be removed from terminals and cleaned by being scraped with a knife, wiped with a damp cloth, and then carefully dried. Terminals, exchange plugs and all exposed metal work, especially the grounds and connecting wires of the Earth Telegraph sets and Radio sets should be cleaned first with a damp and then with a dry cloth. This process should be

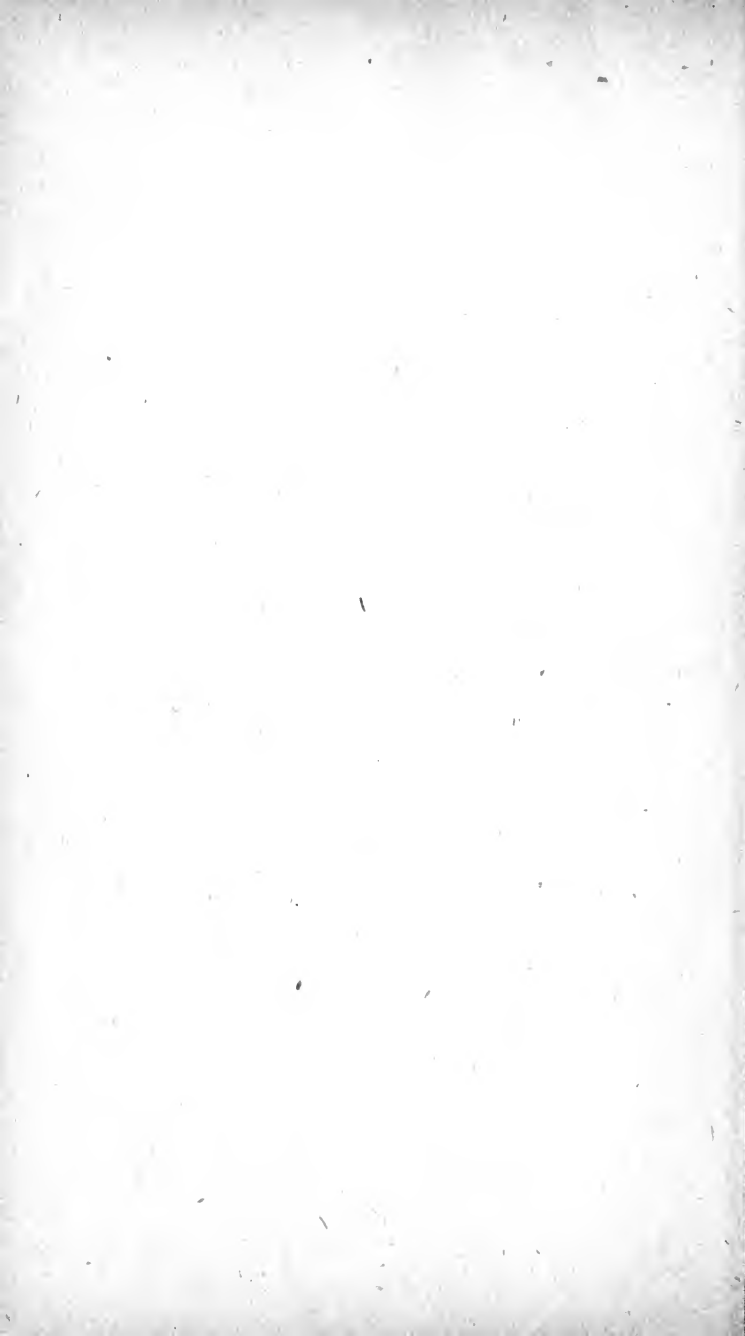
repeated after 12 hours have elapsed. In general, the processes prescribed for cleaning arms and ammunition (pars. 30 to 34, incl.) may be followed for the cases and non-electrical parts and for nonelectrical apparatus.

The internal portions of the instruments should not be interfered with. If an instrument has been kept closed or covered up, it is very unlikely that internal portions will have suffered; but if these portions show signs of corrosion, the instruments should be sent back to Division or Corps Headquarters to be dealt with by an Instrument Repairer.

III. — Protection of carrier pigeons.

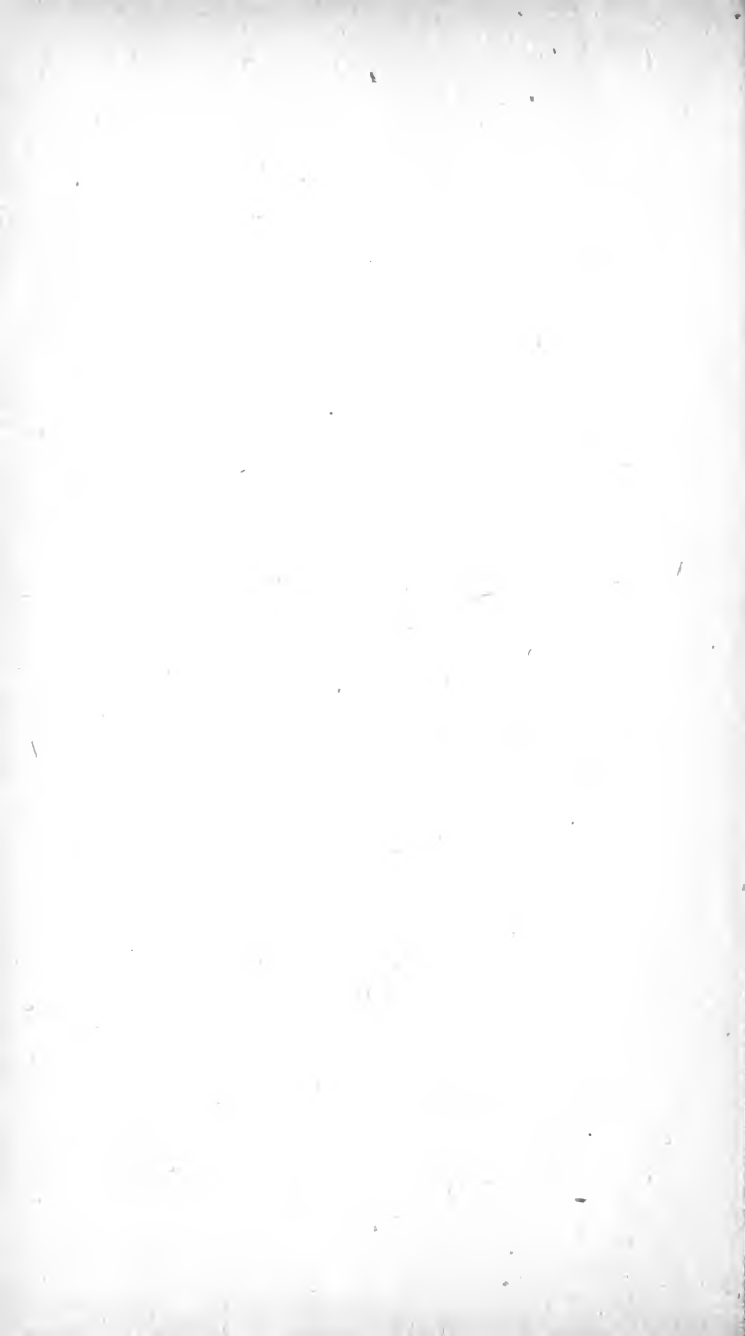
118. When the gas alarm is sounded, all baskets containing pigeons should be placed in the special Anti-Gas Bags provided for this purpose, or placed in gas-proof shelters. If for any reason the birds cannot be protected from the gas, they should be liberated at once. Anti-gas bags should always be kept near baskets containing birds, and should be regularly inspected.

Pigeons can be utilized during a gas attack. Experience has proved that they will fly through any gas cloud, but it is imperative that the bird should be exposed to the gas for as short a time as possible. The message and carrier should, therefore, be prepared and if possible, fastened to the pigeon's leg, before the bird is exposed to the gas. Twenty seconds should suffice to fix a carrier and liberate a bird.



LIST OF APPENDICES.

- I. — Drills with box respirators and masks.
- II. — Inspection of personal anti-gas equipment.
- III. — Instructions for the use of horse respirators.
- IV. — Typical standing orders for Company Gas N. C. O.'s.
- V. — Instructions for making wind observations and furnishing reports.
- VI. — Instructions for taking gas samples and for reporting on hostile gas attacks.



APPENDIX I.

RESPIRATOR AND MASK DRILLS.

The following drills are designed to teach officers and men to adjust quickly their respirators and masks. The drills must be so thoroughly mastered that one will protect himself instantly upon hearing the gas alarm.

The breath must be held from the instant of alarm until the respirator or mask is completely adjusted.

Drills with box respirators.

Drills in defensive measures against gas will be conducted in each division in accordance with the programs of training furnished from these headquarters. After the training period and while not in the trenches, drills "A", "B", and "C" will be practiced twice weekly. While in the trenches or stationed within five miles of the front line, drill "B" will be practiced daily; the actual time during which the box is breathed through being as short as possible.

Drills "D", "G", and "H" will be practiced as frequently as possible, having regard to the amount of time during which the box may be breathed through, the respirator being good for 40 hours breathing.

In the initial training, drills must be so arranged that every man wears the respirator for one full period of an hour without removing the mask or nose clip.

Drill "A".

To bring the Box Respirator to the "Alert" position.

At the command "Gas Alert", hang the box respirator round the neck with the flap next the body. With the right hand seize the satchel by the leather tab, with the left hand seize the sling by the brass button and clip this into the leather tab. Then unfasten the press buttons which close the flap.

The heavy string attached to the top of the satchel will then be withdrawn from the right-hand compartment, passed through the ring on the lower right side of the satchel and carried around the waist to the ring on the left, where it is fastened. The press buttons closing the flap will be left unfastened, but the flap will be pushed into position to keep the respirator from getting wet.

Drill "B".

Drill "by numbers" to obtain complete and accurate adjustment of the box respirator from the "Alert" position.

This drill will be alternated with one without the numbers to insure as quick an adjustment as possible. The drill must be practiced until complete adjustment is obtained by all ranks in **six seconds**.

Before starting the drill, the respirator should be in the "Alert" position with flap down but not buttoned.

1) At the command "**one**", hold the breath, press down both thumbs between the satchel and the body and open the satchel. Immediately seize the face-piece with the right hand so that the metal elbow tube just outside the face-piece will be in the palm of the hand. At the same time knock off the steel helmet from behind with the left hand.

2) At the command "**two**", bring the face-piece quickly out of the satchel and hold it in both hands with all the fingers outside along the binding and the two thumbs inside, pointing inwards and upwards under the elastic. At the same time throw the chin well forward ready to enter the face-piece opposite the nose clip.

3) At the command "**three**", bring the face-piece forward, digging the chin into it and with the same motion bringing the elastic bands back over the crown of the head to the full extent of the retaining tape, using the thumbs.

4) At the command "**four**", seize the metal elbow tube outside the face-piece, thumb up on the right, fingers on the left — all pointing towards the face. Push the rubber mouth-piece well into the mouth and pull it forward until the rim of the mouth-piece lies between the teeth and the lips and the two rubber grips are held by the teeth.

5) At the command "**five**", adjust the nose clip to the nose, using the thumb and first three fingers of the right hand. Run the fingers round the face-piece on either side of the face to make sure that the edges are not folded over. Correct any faults in adjustment. Come quickly to attention.

Drill "C".

To adjust Box respirators when carried over the shoulder but not in the "Alert position".

Pull the satchel around until it hangs in front of the body. Unfasten the flap and adjust the face-piece as in practice "B", allowing the satchel to hang by the rubber tube.

After the nose clip is put on, at once proceed to adjust the satchel in the Alert position, as in practice "A".

Drill "D".

Drill to teach cleaning of eyepieces.

At the command "**Clean eyepieces**", the right eyepiece will be gripped between the thumb and first finger of the left hand. The first finger of the right hand will then be

pushed gently into the fold of the face-piece behind the right eyepiece which will be cleaned with a gentle circular motion.

The left eyepiece will be cleaned in a similar way.

Drill "E".

Drill to teach method of giving orders.

The squad is first cautioned that the nose clip must not be removed to talk and that before each sentence is spoken a long breath must be taken and the mouthpiece removed sideways from the mouth by turning the metal tube outside the face-piece on one side. After speaking and before drawing a breath, the mouthpiece is replaced.

The squad should then call off, intervals extended to four paces, and orders passed down the line.

Officers and N. C. O.'s should receive special practice in Drill "E".

Drill "F".

Drill to teach method of clearing face-piece from gas which may have leaked in.

Press the face-piece close to the face, forcing out foul air around the sides, then fill with air from the lungs by blowing out round the mouthpiece, and end by pressing the face-piece close to the face. Repeat at about 10 minute intervals as long as the face-piece is worn.

Drill "G".

Drill to teach method of testing whether trench or dug-out is free from gas.

With the right hand pull the face-piece slightly away from the right cheek, loosen the nose clip on the nose and sniff gently (do not take a breath). If gas is smelled, the nose clip and face-piece are readjusted. Then clear face-piece of gas as in "F".

Drill "H".

Ordinary infantry drill will be carried out while wearing the mask. This will include double time for at least 200 yards at one time. This drill will be in heavy marching order. Musketry and bombing instructions and the training of specialists (including artillery, machine gunners, Medical Corps, signallers) will also be carried out while wearing the respirator.

Drill "I".

Drill to teach changing from the box respirator to the mask.

At the command "Change" hold the breath, get out the mask, and grip in the left hand. Knock off the steel helmet with the right hand. Take off respirator as in Note b) following. Put on the mask according to the method described

under "Mask Drill". Protection must be obtained in ten seconds or less.

NOTE. — *a)* If after being worn for a long time, the pressure of the nose clip becomes unbearable, it may be relieved for a few moments by easing up the pressure, being careful not to remove the clip from the nose.

b) Removing respirators. — Care must be taken to remove the respirator without stretching the face-piece or elastic. At the command "Take off respirators" release nose clip, insert the fingers of the right hand under the face-piece of the chin, bend the head forward and open the mouth, at the same time removing the face-piece with an upward motion of the right hand.

c) Folding face-pieces. — The face-piece should be folded flat (no part tucked inward) and the elastic bands should be folded against the outside of the face-piece on one side.

d) After all drills the respirator must be wiped dry, folded correctly, and put away in such a way that the rubber valve is not bent.

Freezing or sticking of valve.

In cold weather the saliva on the expiratory rubber valve will freeze. This can be prevented by two drops of glycerine or heavy thick oil. However, as both tend to injure the rubber they should be used only in very cold weather.

The expiratory valve frequently sticks from the saliva drying on it. To prevent this, as well as freezing, always put the respirator away dry. If the respirator is put on and difficulty is experienced in respiration, take the expiratory valve between the thumb and fingers and rub it briskly with a rolling motion; do not remove respirator while doing this, but breathe out through the mouth around mouth piece.

Mask drill.

1. To obtain correct and quick adjustment of the mask the following drill will be carried out "by numbers". As soon as the movements are perfectly understood the number drill will be carried out alternately with "judging the time" drill. That is, as quickly as possible. The breath must be held while adjusting the mask because one breath of the poisonous gases now used may cause death or serious injury.

Remove the mask from the cloth satchel and hang it on the chest by the long tape, with the oiled canvas facing out. This is the "Alert position".

1) At the command "one", grasp the elastic with both hands in the following manner: the 3d, 4th and 5th fingers between the front elastic and the mask; the index fingers

between the two elastics, and the thumbs behind both elastics.

2) At the command **"two"**, pull the hands apart so that the elastics are completely stretched.

3) At the command **"three"**, push the chin well forward, at the same time carrying the hands upward so that the lower edge of the mask catches well under the chin.

4) At the command **"four"**, carry the hands with a circular motion backwards and then downwards, letting go off the first elastic when the tape fastening the elastics together becomes tight and then carrying the posterior elastic as far down the back of the neck as it will go.

5) At the command **"five"**, adjust the edges of the mask with both hands, being particularly careful to see that no hair lies under the edge of the mask and that there are no wrinkles.

6) At the command **"six"**, pass the right hand back of the neck and grasp the elastic hanging down on the left side and carry it back of the neck and fasten it into the hook on the right-hand lower corner of the mask; the forefinger of the left hand will help guide the eye over the hook. Come to attention.

The mask is taken off by unhooking the elastic around the neck and then grasping the bottom of the mask with the right hand; pull down and outward until the mask is free of the chin, then with an upward and backward swing remove the mask from the head.

NOTE. — The elastic that goes behind the neck must be adjusted to the individual when the mask is issued so that it will fit his neck snugly. At the same time the median tape should be shortened by means of the safety pin supplied with it so that it will be taut when the mask is properly applied.

Care should be taken of the eyepieces as they are very fragile. They should never be wiped when moist as it spoils them. Extra eyepieces are provided to replace those in the mask when they become cracked or broken. To remove old ones, bend outward the little metal fasteners of the protecting rim on the front of the mask when the eyepiece frame slips out of the rubber socket. The new eyepiece is put in place from the inside of the mask by introducing one edge of the rim into the rubber groove and stretching the remainder of the rubber groove over the eyepiece. Care should be taken not to press on the transparent part of the eyepiece. Replace the metal rim and press the fasteners back into place.

Men must use their own masks for drill purposes.

Men must be warned that during a gas attack the smell of the chemical on the mask becomes stronger and may cause very slight irritation of the eyes, nose, and throat. This will disappear in a few minutes, and does not indicate that gas is coming through the mask.

Masks will be worn in the **"Alert position"** only when men are not provided with the Box Respirator.

General points on training with anti-gas appliances.

When training men in the use of anti-gas appliances the following points are of importance. They apply equally to box respirators and masks.

a) Practice with simple movements with box respirators or masks. Ordinary infantry drill should be combined with physical drill, including arm and leg exercises, leap-frog, and double time. The time of practice should not exceed 15 minutes at first in the case of the mask, but should be gradually extended.

b) Practice in bombing, rapid loading and aiming, judging distance and rifle firing, should be carried out while men are wearing box respirators or masks.

c) Men must swallow their saliva and not allow it to drain out over the lips or through the valve.

d) Officers and N. C. O.'s will receive the same training as the men, and, in addition, will be practiced in giving orders while wearing their respirators or masks.

Practice and drill in the use of anti-gas appliances should be carried out continuously. This applies especially to troops which return to trench warfare after having been in districts where more open fighting may have led (*a*) to a temporary lapse in this training, (*b*) to the subsequent incorporation of drafts only partially trained in anti-gas measures.

APPENDIX II.

INSPECTION OF PERSONAL ANTI-GAS EQUIPMENT.

A. — Box respirators.

Box respirators must normally be inspected once a week and daily during "Gas Alert." Attention will be paid to the following points :

a) Boxes, facepiece, mouthpiece, noseclip, eyepieces, and elastic must be in good order. If the box is rusted through, the respirator must be condemned.

b) Facepiece must be firmly attached to the mouthpiece and to the elbow tube.

c) The metal tube inside the mouthpiece must be about $\frac{1}{8}$ th in. back from the opening of the latter.

d) The rubber tube must be intact and firmly attached to the box and elbow tube.

e) The expiratory valve should be tested by removing the box from the satchel and either closing the cap at the bottom with the hand, or pinching the rubber tube so as to prevent inlet of air at the same time attempting to draw in air through the mouthpiece. It should not be possible to draw in any air. This also proves the absence of leaks in the tube or box. It must be possible to breathe out easily through the valve. If the latter has stuck because of saliva drying in it, this must be remedied by rubbing the valve between the fingers.

f) See that the inlet valve is opening properly and that air can be drawn freely through the box.

g) See that the cord for tying around the body is present and not knotted.

h) Any small perforations in the facepiece should be temporarily repaired by applying pieces of adhesive plaster from the repair outfit to the perforation, both inside and outside the mask. The adhesive plaster should be large enough to overlap the hole all round.

Respirators so repaired must be exchanged as soon as possible.

i) Replace the box in the satchel so that the facepiece comes to the face without twist on the tube. Fold facepiece carefully and replace in the satchel so that the expiratory valve is not likely to crumple.

B. — Masks.

Masks must be inspected once a week, or daily during the "Gas Alert". Attention must be paid to the following points :

a) See that the carrying case is in good condition.

b) See that the eyepieces are not cracked or loose.

c) See that there is no evidence that the mask has been wet (mould); any mask which has been wet should be condemned.

d) See that elastics and tapes are in good condition.

APPENDIX III.

INSTRUCTIONS FOR THE USE OF BRITISH ANTI-GAS HORSE RESPIRATOR.

I. — Description.

The respirator consists of a flannelette bag with a canvas mouthpiece which goes into the horse's mouth and saves the flannelette from being bitten through. The bag is provided with an elastic band which passes round the opening so as to draw the respirator close to the face when in use. The upper side of the mouth of the flannelette bag is furnished with a small unbleached calico patch by which the respirator is attached to the nose-band of the head collar when in the "Alert position", and while in use. Inside the bag and attached to the canvas mouthpiece there is a canvas frame which is stitched on to the bag, in such a way as to prevent the material drawing into the nostrils when the respirator is in use. The whole is folded and carried in a canvas case provided with a flap, secured by three press buttons, and having two straps at the back by means of which the case is attached to the head collar.

II. — Method of use.

Horses can stand a higher concentration of gas than human beings without material damage, and it is not therefore necessary to protect them against cloud gas attacks when they are a considerable distance back from the trenches. Nor is it necessary to protect their eyes. The respirator is primarily intended for use on transport animals when they are sent to the vicinity of the trenches with supplies and ammunition. In the case of gas shell attacks, horses should be protected wherever the shelling is heavy.

1) *Carrying when not immediately required.*

When not required for immediate use the respirator can be conveniently carried on the supporting strap of the breast harness as shown in Fig. 5, or if a zinc wither pad is worn, still more conveniently inside this pad. If a collar is used in place of the breast-strap, it can be carried in the channel of the collar where drivers often carry a sponge. However carried, the case is steadied by being strapped on either side to the metal ring on the supporting strap, and its flap should be passed under this strap, between it and

the nunnah wither pad, and buttoned as in the "Alert position".

2) *Alert Position.*

When horses are being sent up to the trenches, the transport or other officer responsible should have the respirators adjusted in the "Alert position" before moving off, as follows :

a) The flap of the respirator case is unbuttoned and slipped under the nose-band of the head collar from below upwards.

b) The two straps at the back are also passed under the nose-band and secured to the cheek pieces of the head collar, above the metal D on each side.

c) The small unbleached calico patch on the upper side of the mouth of the respirator is buttoned on to the nose-band of the head collar so that the respirator is ready to be slipped on immediately in the event of a gas attack.

d) The cover of the case is then closed over the nose-band, and the respirator is thus protected from rain, and held in position on the nose-band. Fig. 6 shows a respirator in its case carried in the "Alert position".

3) *Wearing in Gas.*

The respirator being carried in the "Alert position" is adjusted for use as follows :

a) The flap of the case is unbuttoned and the respirator removed, leaving the case attached to the cheek pieces of the head collar and lying flat on the face.

b) The mouth of the bag is drawn down over the upper lip and upper teeth with one hand on each side of the mouthpiece, slipped into the mouth, and drawn well up to the angle of the lips.

c) The elastic band is seized on either side close to the mouthpiece, and pulled outwards so as to draw the mouth of the bag tight around the upper jaw, above the nostrils, and is then slipped over the poll.

The respirator is then in position and the animal may be worked in it without difficulty or undue distress. The bit and reins are not interfered with in any way. This is shown in Fig. 7.

4) *Replacement in Case.*

In folding the respirator and replacing it in the case ready for use the following points should be observed :

a) The canvas mouthpiece should be wiped as clean as possible.

b) The flannelette bag should be held with the canvas mouthpiece underneath and the elastic band placed over the top of the bag in such a way that when the canvas patch is buttoned on to the nose band the elastic band has simply to be passed straight up over the face and over the poll. The bottom end of the respirator should then be tucked in and rolled up over the elastic band to make a neat roll for insertion in the canvas case.

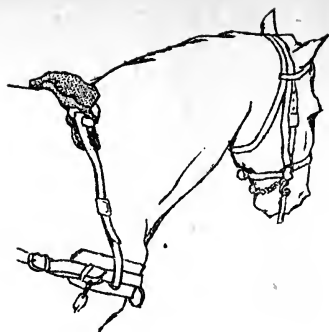


Fig. 5.

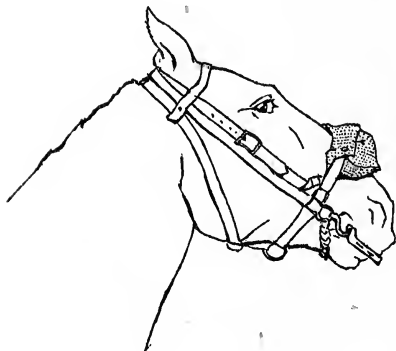


Fig. 6.

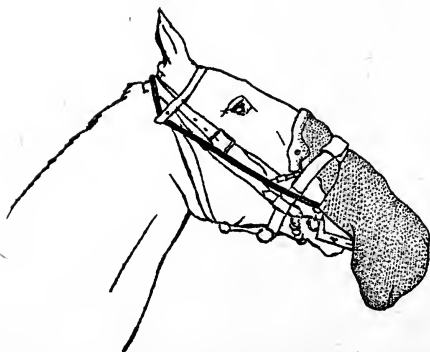


Fig. 7.

APPENDIX IV.

TYPICAL STANDING ORDERS FOR COMPANY GAS N. C. O.'s.

1) They will assist officers at the inspection of box respirators and masks, and in making such local repairs as are possible. They will assist in training men in the use of anti-gas appliances.

2) Under the Company Commander they will have charge of all anti-gas trench stores as follows :

a) *Strombos Horns and Other Gas Alarm Devices.* — Inspect daily and see that sentries posted at them know how they should be used.

b) *Gas-proof Shelters.* — See that the blanket doorways fit and are kept in good order.

c) *Anti-gas Fans.* — See that they are in their proper position and in serviceable condition.

d) *Stores of fuel* for clearing shelters. — Insure sufficient supply for clearing all dug-outs, to be maintained under company arrangements.

e) *Vermorel Sprayers.* — Maintain in working order and see that supply of solution is available.

f) *Gas Sampling Apparatus.* — Have charge of the vacuum bulbs and gas-testing tubes. Keep a stock of corked bottles and small tins with well-fitting lids for collecting samples of earth and water after a gas shell attack.

3) On relief they will assist the Company Commander in taking over all anti-gas trench stores. The Company Gas N.C.O.'s should accompany the advance party and take over anti-gas trench stores (by daylight if possible).

4) They will make wind observations every three hours or more frequently if the wind is in or nearing a dangerous quarter, and will report any change of wind to the Company Commander.

5) During a gas cloud attack they will take gas samples by means of the vacuum bulbs and gas-testing tubes.

6) During or after the attack the N.C.O. must note down in writing as much information regarding the attack as possible. (See Appendix VI.)

7) As soon as possible after the conclusion of a gas shell bombardment, the Gas N.C.O. must fill his bottles and tins (2, f) and take samples of water, mud, or earth from those parts of the line which are smelling most strongly of shell gases. He should note the position of any blind shells. (See Appendix VI.)

8) As soon as possible after a gas attack, all samples and notes will be handed in to the Company Commander for transmission to the Division Gas Officer.

APPENDIX V.

INSTRUCTIONS FOR MAKING WIND OBSERVATIONS AND FURNISHING REPORTS.

Wind reports are to be made and handed to the Company Commander every three hours, or oftener if the wind is in or approaching a dangerous quarter. In order to make these reports the following points must be attended to :

I. — Wind vane.

A simple wind vane must be set up. The vane must have as little friction as possible, so that a wind under 2 miles per hour will turn it. A little post at the top of the vane should carry a strip of linen 5 in. by $\frac{3}{4}$ in., by the movements of which the strength of the wind can be judged.

The vane must be set up sufficiently high to get a true observation (e. g., 18 in. above the top of the dugout, etc.). Correct orientation should be obtained by getting N by the N star and S by the sun at midday (Greenwich time).

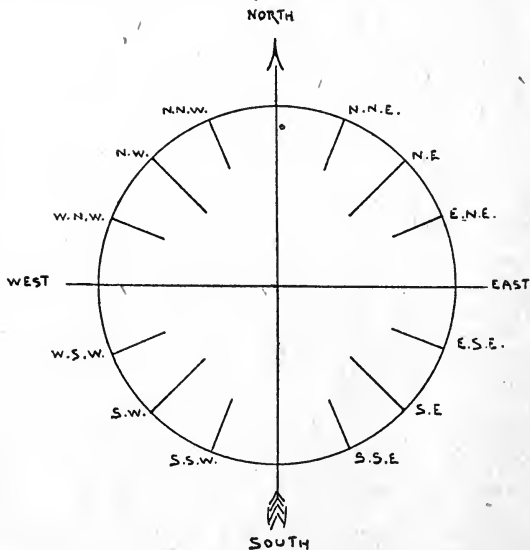


Fig. 8.

II. — Direction of wind.

Before reading the direction of the wind from the vane the observer should gauge the approximate direction by noting the course taken by smoke, etc. Direction of wind must be stated in points of the compass.

The points of the compass to be used are shown in Fig. 8.

III. — Strenght of wind.

This may be judged from Beaufort's scale.

BEAUFORT'S No.	SPEED IN m. p. h.	OBSERVATIONS of Natural objects.	BEHAVIOUR of flag at top of Vane.
0	0	Smoke straight up.	No movement.
1	2	Smoke slants.	No movement.
2	5	Felt on face.	Slight.
3	10	Paper, etc., moved.	3/4 up.
4	15	Bushes sway.	Up and falling often.
5	20	Tree tops sway.	Up. Falling less often.
6	30	Wavelets on water. Trees sway and whistle.	Up and flapping.

IV. — Type of report.

The points North, South, East and West must be written in full. Other points are denoted by the usual letters.

The following example shows the type of report which should be made :

Wind report.

Trench No. 131.

Date 10. 16. 16.

TIME.	DIRECTION.	SPEED.
6 p m.	N. N. W	12 m. p. h.

V. — Warning available.

The following simple calculation determines the number of seconds which it will take for a gas cloud to move from the enemy's lines to our own :

Double trench distance (in yards) and divide by speed of wind (in m. p. h.). Example = $\frac{100 \times 2}{10} = 20$ seconds.

APPENDIX VI.

INSTRUCTIONS FOR TAKING GAS SAMPLES AND FOR REPORTING ON HOSTILE GAS ATTACKS.

I. — Taking gas samples during a cloud gas attack.

A) VACUUM BULBS.

a) Open the hinged lid at the end of the box containing the bulb.

b) Remove the file from the plasticine stopper and with it make a scratch on the glass tube at the narrowest point.

c) Hold the tube with finger and thumb of each hand and snap it where it is scratched; air will immediately rush in and fill the bulb.

d) Samples should be taken, 18 inches, and 4 feet above the bottom of the trench.

e) Press home the cap containing plasticine over the broken end of the tube so as to seal up the contents of the bulb.

Samples of gas should be taken both in the fire and support trenches. The first sample should be taken about two minutes after the commencement of the attack, and other samples at intervals during the attack.

The exact time and place should be noted on the form on the back of the box immediately after the sample is taken.

After the gas waves have passed, samples of air in unprotected dugouts should be taken before the latter are cleared.

Immediately after vacuum bulbs have been used they should be taken under shelter.

B) GAS-TESTING TUBES.

In the intervals of taking gas samples with vacuum bulbs, a *Gas-Testing Tube* should be used. Open the box by stripping off the adhesive plaster and pulling off the lid; pull out the small glass stopper and pump air through the apparatus by squeezing the rubber ball in the hand for 10 minutes. If the number of times the ball is squeezed is counted and recorded, useful information may be obtained. After the sample has been taken, replace the small glass stopper, and *at once* replace the lid of the box, taking care to avoid compressing the rubber ball. Note on the label the time and place at which the sample was taken.

II. — Collection of specimens after a gas shell bombardment.

As soon as possible after the conclusion of a gas shell bombardment, the Gas N. C. O. must take samples of water or earth from those parts of the line which are smelling most strongly of shell gases. He should note the spots at which the samples were taken.

During and after a gas attack the Gas N. C. O. should note down in writing as much information as possible on the following points :

- a) Strength and direction of wind and general weather conditions.
- b) Times at which the gas wave or gas shell bombardment started and finished.
- c) Exact position and nature of place affected by gas or gas shells.
- d) Color and color changes of the gas cloud.
- e) Sound of escaping gas.
- f) Smell of gas and gas shells.
- g) Effect of gas and gas shells on men.
- h) To what extent telephone dugouts, covered gun and machine gun emplacements, etc., were affected.
- i) The approximate number of gas shells used and their calibre.
- j) The position of blind shells and fragments of shells, etc.

III. — Forwarding of samples, specimens, and reports.

After an attack, cloud gas samples, gas testing tubes, gas shell bases and fragments, shell gas samples, and notes on the attack will be handed to the Company Commander as soon as possible for transmission to the Chief Gas Officer of the Division.



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